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Microhabitat Requirements and Movements of Juvenile Coho and Chinook Salmon at Three Streamflows in Kloiya Creek, B.C.

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Fisheries and Oceans Pêches et Océans

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Canadian Data Report of Fisheries and Aquatic Sciences

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ABSTRACT

Bravender, B. A. and C. S. Shirvell. 1990. Microhabitat requirements and movements of juvenile coho and chinook salmon at three streamflows in Kloiya Creek, B.C. Can. Data Rep. Fish. Aquat. Sci. 802: 159 p.

In conjunction with a study on the effects of altered streamflow on the physical characteristics of a small coastal stream, the microhabitat requirements and movements of juvenile coho and chinook salmon were investigated. The flow level of Kloiya Creek, B.C. was adjusted to 1.17-1.64 $m^3 \cdot s^{-1}$ (drought), 1.65-3.35 $m^3 \cdot s^{-1}$ (normal) and 3.36-8.02 $m^3 \cdot s^{-1}$ (flood). Seventy-seven juvenile salmon (40 coho and 37 chinook) were tagged and the direction and distance they moved in response to the altered flows were determined by underwater observation. Measurements of depth, velocity, and light intensity and the type of substrate were taken at each fish's location for each streamflow level.

RÉSUMÉ

Bravender, B. A. and C. S. Shirvell. 1990. Microhabitat requirements and movements of juvenile coho and chinook salmon at three streamflows in Kloiya Creek, B.C. Can. Data Rep. Fish. Aquat. Sci. 802: 159 p.

Nous avons étudié simultanément les effets de différents débits sur les caractéristiques physiques d'un petit cours d'eau côtier de même que les préférences relatives au micro-habitat et les déplacements de saumons cohos et quinnats juvéniles suite aux changements de débit. Le débit du ruisseau Kloiya, en Colombie-Britannique, a été successivement fixé à 1,17 - 1,64 $m^3 \cdot s^{-1}$ (débit de sécheresse), 1,65 - 3,35 $m^3 \cdot s^{-1}$ (débit normal) et 3,36 - 8,02 $m^3 \cdot s^{-1}$ (débit de crue). Soixante-dix-sept saumons juvéniles (40 cohos et 37 quinnats) ont été marqués et nous avons noté, en les observant sous l'eau, la direction qu'ils ont empruntée de même que la distance qu'ils ont parcourue suite aux modifications du débit. La profondeur, la vitesse du courant et l'intensité lumineuse ont été mesurées et nous avons décrit le type de substrat à chaque site d'observation et pour chacun des débits.

INTRODUCTION

Management, protection and enhancement of freshwater habitat for juvenile salmon is dependent on an understanding of the importance of a number of environmental factors such as water depth, velocity, light and substrate. These parameters are all subject to change as streamflow increases or decreases, especially below artificial dams where the changes occur suddenly and with little warning. Although there are many dams in British Columbia constructed on salmon rearing streams, there is little knowledge of how the juvenile fish deal with these sudden alterations of flow. Some studies suggest that they may be forced to move to other locations or even be flushed downstream during periods of high flow (Tschaplinski and Hartman 1983, Heggenes 1988).

To investigate this question, a project was carried out during 1985 on a small stream on the north coast of British Columbia. Kloiya Creek, located approximately 15 km southeast of Prince Rupert, is about 2 km long and empties into Kloiya Bay (Fig. 1). The 125 km^2 drainage area includes four lakes, three of which have been impounded to store water for a local pulp mill. The average annual rainfall for this area is 2855 mm and the stream discharge between 1972-82 varied from a minimum of 0.130 $m^3 \cdot s^{-1}$ in August to a maximum of 94.3 $m^3 \cdot s^{-1}$ in October.

All five species of Pacific salmon spawn in this system. Sockeye (*Oncorhynchus nerka*) are most abundant followed by coho (*Oncorhynchus kisutch*), pink (*Oncorhynchus gorbuscha*), chinook (*Oncorhynchus tshawytscha*) and chum (*Oncorhynchus keta*). The coho and chinook juveniles remain in Kloiya Creek for different periods to rear before migrating to sea. In conjunction with this study, the physical parameters of five pools in the stream were measured under three streamflow regimes (Bravender and Shirvell, 1989). Here we present the movements of the juvenile coho and chinook salmon and the microhabitat measurements at each capture location at three streamflows. In addition, microhabitat measurements were made for 442 juvenile fish (311 chinook, 130 coho and 1 steelhead) which were not included in the movements study.

MATERIALS AND METHODS

The study areas used for this investigation consisted of five separate pools about 800 m downstream from the dam at the outlet of Prudhomme Reservoir (Figure 1). The pools were adjoining but in two groups: pools 1 and 2 formed the upstream

group and pools 3, 4 and 5 formed the downstream group. These pools averaged 47 m long, 21 m wide and 52 cm deep at their deepest points (Figures 2, 3). They had predominately cobble substrate with gravel and sand at the margins. Bravender and Shirvell (1989) give a thorough description of the physical characteristics of the pools.

Both coho and chinook salmon spawn in each group of pools. After emerging from the gravel, the juvenile salmon rear in the pools for periods of a few days up to several months before emigrating to sea. The habitat conditions individual fish occupied at three different streamflow levels were measured and the distances individual fish moved following a change in streamflow were calculated. Streamflow was altered in Kloiya Creek by opening or closing different gates on the Prudhomme Reservoir dam and the streamflow ranges chosen were representative of the typical seasonal extremes for this system. The three streamflow levels studied were $\bar{X}$=1.25 $m^3 \cdot s^{-1}$ (range 1.17-1.64 $m^3 \cdot s^{-1}$, labelled drought), $\bar{X}$=2.56 $m^3 \cdot s^{-1}$ (range 1.65-3.35 $m^3 \cdot s^{-1}$, labelled normal), and $\bar{X}$=5.42 $m^3 \cdot s^{-1}$ (range 3.36-8.02 $m^3 \cdot s^{-1}$, labelled flood). Kloiya Creek has a mean annual streamflow of 6.4 $m^3 \cdot s^{-1}$ so the drought, normal and flood streamflows were 20%, 40% and 84% respectively of the mean annual discharge. The mean seasonal streamflow (June and July) was 3.41 $m^3 \cdot s^{-1}$ so the drought, normal and flood streamflows were 37%, 75% and 159% respectively of the normal June and July flows.

Individual juvenile fish were located by direct underwater observation. A diver with snorkel would quietly enter one of the study pools at its downstream riffle and cautiously move upstream until a juvenile salmon maintaining position in the current was observed. The diver would note the position of the individual fish in relation to the substrate and then capture the fish alive in a small, hand-held purse-seine (Morantz et al. 1987).

Following capture of the fish, the habitat conditions at the precise position the fish had been occupying were recorded. Water velocity at the fish's position ($cm \cdot s^{-1}$), water velocity 30 cm above the fish's position ($cm \cdot s^{-1}$) and water velocity 30 cm laterally to the fastest side of the fish's position ($cm \cdot s^{-1}$) were all measured with a Marsh-McBirney current meter. The total water column depth and the height of the fish above the bottom were recorded to the nearest cm and the dominant substrate type determined according to the Modified Wentworth Particle Size Scale. The light intensities at the fish's position and at the water's surface (lux x 10^3) were also recorded with a Li-Cor LI-188B photometer. The location of each fish in the pool was recorded and determined by triangulation measurements from the fish's position to permanent metal bench

marks along the margin of the pool marking the ends of the transects used for the hydrology measurements (Figures 2 and 3) (see Bravender and Shirvell 1989 for a description of the bench marks). These measurements were later marked on scale maps of the pools back in the laboratory.

Once the habitat measurements were taken, the fish were anaesthetized and then weighed to the nearest 0.1 g and measured (fork length) to the nearest millimeter. Each fish was then marked with an individually color-coded staple tag. These tags consisted of an aluminum staple which was attached to the fish by pinching the ends into the dorsal musculature on either side of the dorsal fin so that the staple hung behind the dorsal fin and rested on the fish's back between the dorsal fin and the adipose fin. Each tag was individually marked with a two or three color code of enamel paint applied to the top of the staple. This color code could be read underwater by the diver without requiring the capture of the fish. Following measurements and tagging, the fish was allowed to recover and then was released.

On subsequent observations of tagged fish, the tag code was noted and all of the habitat variables were remeasured at the position the fish was observed to be occupying. Distance and direction moved since the last observation were determined from measurements between subsequent locations on the scale maps. The direction a fish moved between a streamflow change was coded according to the numbers on a clock where 12 designated movement upstream, 6 designated movement downstream, 3 designated movement inshore, and 9 designated movement offshore (Figures 4, 5). Of particular importance, note that the clock was "flipped over" on the right hand side (facing downstream) of the thalweg. This caused 3 to always indicate movement inshore and 9 to always indicate movement offshore regardless of which side of the river the fish was observed on. The change in streamflow since the last observation was determined and matched with the distance and direction moved between two chronological observations of the same fish. All observations and measurements were taken between June 18 and July 19, 1985.

RESULTS

The air and water temperatures (°C), level of the creek (m), flow type (drought, normal, or flood), flow volume ($m^3 \cdot s^{-1}$) and streamflow changes for each date of the project are listed in Table 1. Air temperature ranged from 8.9 to 17.5°C and water

temperature varied from 11.0 to 15.8°C. Water gauge heights (Water Survey of Canada) ranged from 0.59 m to 0.845 m and flow volumes from 1.17 $m^3 \cdot s^{-1}$ to 8.02 $m^3 \cdot s^{-1}$. There were four drought flows, seven normal flows and ten flood flows during the course of the study. Nine different types of streamflow change occurred.

The location and length of the twenty transects in the five pools as well as the wetted surface width of the pools at the drought streamflow are illustrated in Figures 2 and 3. Transects perpendicular to the streamflow mark the riffles bounding each pool. The 0/4 transect marks the downstream riffle and the 4/4 transect marks the upstream riffle of each pool. Table 2 lists the codes used in all tables for substrate type where the fish were located, fish species, the change in streamflow level between sampling dates and the direction the fish moved in the stream from one capture site to the next. Seventy-seven juvenile salmon (40 coho and 37 chinook) were captured, tagged and released during the study (Table 3).

The microhabitat data recorded for each fish may be found in Table 4, including elapsed days from capture to recapture, water depth (cm), nose velocity ($cm \cdot s^{-1}$), lateral velocity ($cm \cdot s^{-1}$), vertical velocity ($cm \cdot s^{-1}$), height above the bottom (cm), substrate type, light level at the fish's location (lux x 10^3), light level at the surface of the water (lux x 10^3), the distance moved between captures (m), the direction (upstream, downstream, inshore, offshore) and angle of any movement (measured on the face of a clock, with upstream at 12 and downstream at 6 o'clock) and the streamflow change between captures. The map numbers for each capture are also included (Fig. 4 and 5). The angle of movement was derived from the clocks shown on Figures 4 and 5. Movements were related to the clock on the same side of the thalweg. An asterisk after the angle denotes the reverse clock on the right side of the stream (facing downstream) was used. The time from capture to recapture varied from 1 to 22 days and water depth ranged from 13 to 83 cm. The nose velocity measured between 0 and 57 $cm \cdot s^{-1}$. The velocity 30 cm laterally to the fish was between 0 and 61 $cm \cdot s^{-1}$ and the vertical velocity changed from 0 to 72 $cm \cdot s^{-1}$. The fish were found between 2 and 52 cm above the bottom and the most common substrate type was cobble. Light at the fish's position ranged from 1.1 to 57.7 lux x 10^3 and the surface light values were between 1.2 and 97.0 lux x 10^3. The fish moved between 0.2 and +50.0 m (the approximate distance between the upstream group of pools and the downstream group of pools) and upstream or downstream with about the same frequency. The most common angles of movement were 6, 7 and 11 0'clock. The most frequently occurring streamflow changes were normal to flood followed by flood to drought.

In Table 5, all the tagged fish are listed including fish number, weight (gm), length (mm), date tagged, species, pool number at tagging, recapture dates, pool number where recaptured and the tag number and colour code. The coho ranged in length from 48 to 89 mm ($\bar{X}$= 55.4 mm) and weighed between 1.2 and 7.7 grams ($\bar{X}$= 1.9 g). The chinook juveniles varied from 49 to 64 mm in length ($\bar{X}$= 53.8 mm) and 1.1 to 2.8 grams in weight ($\bar{X}$= 1.7 g). Of the 77 fish tagged originally, 34 were recaptured (24 coho, 10 chinook). Two fish (coho numbers 8 and 15) were each captured nine times. Forty-three of the fish, 16 coho and 27 chinook, were never recaptured at all. Tagging began on June 18 and continued until July 12 while the recaptures occurred between June 23 and July 19. Ninety-one percent of the fish of both species were recaptured in the same pool in which they were originally tagged. Three fish (coho numbers 2 and 6 and chinook number 46) were recaptured in pools other than the one in which they were tagged. All the movements for the individual fish are plotted in Figs. 6-38, including the capture location number and the streamflow level (D=drought, N=normal, F=flood).

Table 6 lists the distance (m) moved from the original tagging location. This was the distance that the fish had moved from where they were originally tagged to where they were recaptured each time. Ninety-seven movements were measured for thirty-three fish (23 coho and 10 chinook). The shortest distance moved was 0.2 m and the longest distance was +50.0 m (from pool 3 to pool 1, coho #2 and chinook #46). Table 7 presents the mean distances (m) moved from the original tagging location. All the movements for each streamflow change were grouped by species and the mean distances calculated ranged from 2.1 to 22.0 m for the nine streamflow change types. The most movements (14) were recorded on the normal to flood streamflow change followed by the drought to normal change (12).

Distance moved from the last capture location (m) for each individual fish may be found in Table 8. This was the distance that the fish had moved from one capture location to the next. Of the ninety-seven distances recorded, the shortest movement was only 0.2 m and the longest was again +50.0, from pool 3 to pool 1 for coho #2 and chinook #46. The mean distance (m) from the last location may be found in Table 9. This ranged from 1.4 to 50.0 m. The microhabitat measurements for the additional 442 fish may be found in Appendix I. Fish species codes are 1 = coho, 2 = chinook and 3 = steelhead juveniles. The substrate codes are the same as used in the movements study.

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Table 1. Kloiya Creek microhabitat study 1985. Water levels (m), flow volumes ($m^3 \cdot s^{-1}$) and air and water temperatures (°C) for each date sampled in Kloiya Creek.

Start of sampling									
Year	Month	Day	Time (PST)	Air Temp. °C	Water Temp. °C	Water Level[1] (m)	Flow Type[2]	Flow $m^3 \cdot s^{-1}$[3]	Streamflow Change
85	6	18	0856	14.0	12.5	0.845	Flood	8.02	-
85	6	19	0815	12.8	12.9	0.83	Flood	7.46	Flood to Flood
85	6	19	1230	15.0	13.0	0.84	Flood	7.83	Flood to Flood
85	6	20	0930	9.0	11.5	0.71	Flood	3.60	Flood to Flood
85	6	21	0900	8.9	11.5	0.69	Normal	3.10	Flood to Normal
85	6	23	1300	10.0	11.0	0.735	Flood	4.30	Normal to Flood
85	6	24	1050	14.5	11.0	0.59	Drought	1.17	Flood to Drought
85	6	25	1200	15.0	11.0	0.59	Drought	1.17	Drought to Drought
85	6	26	0930	9.0	11.4	0.78	Flood	5.70	Drought to Flood
85	6	27	1315	10.5	11.0	0.69	Normal	3.10	Flood to Normal
85	6	28	1100	12.0	11.5	0.66	Normal	2.44	Normal to Normal
85	7	2	0930	15.6	13.2	0.72	Flood	3.87	Normal to Flood
85	7	3	0830	17.0	13.0	0.79	Flood	6.04	Flood to Flood
85	7	5	0815	13.5	14.5	0.60	Drought	1.32	Flood to Drought
85	7	8	1015	17.5	15.5	0.64	Normal	2.02	Drought to Normal
85	7	9	1100	16.7	15.5	0.64	Normal	2.02	Normal to Normal
85	7	10	0900	15.0	15.0	0.71	Flood	3.60	Normal to Flood
85	7	12	1100	13.7	15.8	0.60	Drought	1.32	Flood to Drought
85	7	15	1020	-	-	0.635	Normal	1.92	Drought to Normal
85	7	17	0900	15.0	15.0	0.795	Flood	6.22	Normal to Flood
85	7	19	0847	16.5	15.2	0.65	Normal	2.22	Flood to Normal

[1]Water height (m) from gauge tracing at time sampling began (Water Survey of Canada Station No. 08EG016).
[2]Classification of flow levels - Drought 0.00 to 0.62 m (1.17 - 1.64 $m^3 \cdot s^{-1}$); normal -0.63 to 0.69 m (1.65 - 3.35 $m^3 \cdot s^{-1}$); flood -0.70+ m (3.36 - 8.02 $m^3 \cdot s^{-1}$).
[3]Streamflow calculated from Water Survey of Canada gauge tracing at time sampling began using Table 21 Stage - Discharge Rates (WSC).

Table 2. Kloiya Creek microhabitat study 1985. Codes used for substrate types, species of fish, changes in streamflow between sampling dates and the direction moved by the juvenile coho and chinook salmon in Kloiya Creek.

[1]SUBSTRATE TYPE	CODE
Gravel (2-64 mm)	1
Cobble (64-250mm)	2
Boulder (250-4000+mm)	3
Sand (.062-1mm)	4
Wood	5
Bedrock	6
SPECIES	**CODE**
Coho	1
Chinook	2
[2]STREAMFLOW CHANGES	CODE
Drought to Drought	1
Drought to Normal	2
Drought to Flood	3
Normal to Drought	4
Normal to Normal	5
Normal to Flood	6
Flood to Flood	7
Flood to Normal	8
Flood to Drought	9
DIRECTIONS MOVED	
Upstream	15
Downstream	16
Inshore	17
Offshore	18

[1]The dominant particle sizes according to the Modified Wentworth Particle Size Scale.
[2]The changes in streamflow level between captures.

Table 3. Kloiya Creek microhabitat study 1985. Fish number and tag colour of juvenile coho and chinook salmon tagged in Kloiya Creek.

Fish No.	Tag Colour	Species
1	White-1-Blue	Coho
2	White-2-Blue	Coho
3	White-3-Blue	Chinook
4	White-4-Blue	Coho
5	White-5-Blue	Chinook
6	White-1-Red	Coho
7	White-2-Red	Chinook
8	White-3-Red	Coho
9	White-4-Red	Coho
10	White-5-Red	Coho
11	Blue-1-White	Chinook
12	Blue-3-White	Chinook
13	Blue-4-White	Coho
14	Blue-5-White	Chinook
15	Blue-2-White	Coho
16	Red-1-White	Coho
17	Red-2-White	Coho
18	Red-3-White	Coho
19	Red-4-White	Coho
20	Red-5-White	Coho
21	Blue-1-Yellow	Chinook
22	Blue-2-Yellow	Coho
23	Blue-3-Yellow	Chinook
24	Blue-4-Yellow	Chinook
25	Blue-5-Yellow	Chinook
26	Yellow-1-Red	Chinook
27	Yellow-2-Red	Chinook
28	Yellow-3-Red	Coho
29	Yellow-4-Red	Chinook
30	Yellow-5-Red	Coho
31	Yellow-1-Blue	Chinook
32	Yellow-2-Blue	Coho
33	Yellow-3-Blue	Chinook
34	Yellow-5-Blue	Coho
35	Yellow-4-Blue	Chinook
36	Yellow-Red-Blue	Coho
37	Yellow-Blue-Red	Chinook
38	Blue-Yellow-Red	Coho
39	White-Red-Blue	Chinook

Table 3 (cont'd)

Fish No.	Tag Colour	Species
40	Blue-White-Red	Coho
41	Red-Blue-White	Coho
42	White	Coho
43	Red	Coho
44	Blue	Coho
45	Yellow	Chinook
46	Black	Chinook
47	Black-1-White	Chinook
48	Black-2-White	Chinook
49	Black-3-White	Chinook
50	Black-4-White	Chinook
51	Black-5-White	Chinook
52	Black-1-Red	Chinook
53	Black-2-Red	Coho
54	Black-3-Red	Coho
55	Black-4-Red	Coho
56	Black-5-Red	Chinook
57	Black-1-Yellow	Chinook
58	Black-2-Yellow	Coho
59	Black-3-Yellow	Chinook
60	Black-4-Yellow	Chinook
61	Black-5-Yellow	Coho
62	Black-1-Blue	Coho
63	Black-2-Blue	Coho
64	Black-3-Blue	Coho
65	Black-4-Blue	Chinook
66	Black-5-Blue	Chinook
67	Black-1-Green	Chinook
68	Black-2-Green	Chinook
69	Black-3-Green	Coho
70	Black-4-Green	Coho
71	Black-5-Green	Coho
72	Green	Chinook
73	Green-1-White	Chinook
74	Green-2-White	Chinook
75	Green-3-White	Coho
76	Green-4-White	Coho
77	Green-5-White	Coho

Table 4. Kloiya Creek microhabitat study 1985. Microhabitat data recorded for each individual coho and chinook salmon at tagging and recapture.

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^3)	Light at Surface (lux x 10^3)	Distance Moved (m)	Direction	Angle	Flow Change
1	1	1	6	18	1	.	6	18	.	38	33	31	50	3	2	8.2	15.1	.	.	.	.
2	1	2	6	19	1	.	6	19	.	34	24	34	24	10	1	46.0	85.6	.	.	.	.
2	2	2	6	19	1	39	6	27	8	47	20	31	18	10	2	16.6	15.7	.	.	.	.
2	3	2	6	27	1	78	7	3	6	48	17	26	15	15	1	9.7	16.3	4.6	16	5	6
2	4	2	7	3	1	116	7	10	7	34	12	18	14	4	.	10.5	19.1	+50.0	16	6	7
2	5	2	7	10	1	127	7	12	2	46	0	0	0	31	1	10.2	18.8	8.6	15	12*	9
2	6	2	7	12	1	139	7	15	3	45	5	9	11	10	2	.	.	12.8	16	7*	2
2	7	2	7	15	1	147	7	17	2	42	29	22	38	7	2	.	.	13.9	15	10*	6
2	8	2	7	17	1	170	7	19	2	55	12	16	15	11	1	.	.	12.5	16	8	8
3	1	3	6	19	2	.	6	19	.	38	21	24	59	10	2	45.2	80.4	.	.	.	.
3	2	3	6	19	2	31	6	27	8	20	7	10	26	5	2	20.2	31.3	.	.	.	8
3	3	3	6	27	2	68	7	3	6	27	13	14	39	2	2	2.9	4.7	1.8	17	3	6
4	1	4	6	19	1	.	6	19	.	30	13	27	58	5	1	57.7	87.3	.	.	.	.
4	2	4	6	19	1	76	7	3	14	22	18	18	40	3	2	12.2	13.0	.	.	.	7
4	3	4	7	3	1	133	7	12	9	43	18	28	30	5	2	16.1	37.1	5.0	15	12	9
5	1	5	6	19	2	.	6	19	.	39	12	15	59	6	1	44.1	88.0	.	.	.	.
5	2	5	6	19	2	8	6	23	4	40	21	31	19	14	2	4.6	8.0	.	.	.	7
5	3	5	6	23	2	19	6	25	2	44	9	19	12	13	1	4.4	11.9	5.0	15	11	9
5	4	5	6	25	2	34	6	27	2	29	25	32	42	3	2	16.1	27.2	5.6	16	6	2
6	1	6	6	19	1	.	6	19	.	30	16	26	60	6	2	19.7	41.8	.	.	.	.
6	2	6	6	19	1	42	6	27	8	36	16	28	49	5	3	13.2	31.0	.	.	.	8
7	1	7	6	19	2	.	6	19	.	40	12	24	72	8	2	26.8	41.9	.	.	.	.
8	1	8	6	20	1	1	6	20	.	35	19	30	30	4	1	12.5	22.5	.	.	.	.
8	2	8	6	20	1	18	6	25	5	42	16	19	33	4	2	6.9	9.6	3.8	15	11	9

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^3)	Light at Surface (lux x 10^3)	Distance Moved (m)	Direction	Angle	Flow Change
8	3	8	6	25	1	67	7	3	8	28	18	15	36	7	1	7.4	10.5	9.6	16	5	3
8	4	8	7	3	1	91	7	5	2	44	8	33	37	5	1	7.4	12.9	8.5	15	11	9
8	5	8	7	5	1	100	7	8	3	43	29	27	26	10	1	12.6	25.8	0.4	15	1	2
8	6	8	7	8	1	120	7	10	2	35	22	30	27	7	.	7.0	17.8	12.0	16	6	6
8	7	8	7	10	1	131	7	12	2	44	17	38	41	10	1	15.6	26.2	12.0	15	12	9
8	8	8	7	12	1	144	7	15	3	43	25	23	41	6	1	.	.	17.8	16	6	2
8	9	8	7	15	1	156	7	17	2	29	17	17	28	7	1	.	.	10.4	15	1	6
8	10	8	7	17	1	160	7	19	2	41	26	30	37	6	2	.	.	10.0	15	11	8
9	1	9	6	20	1	2	6	20	.	40	17	22	24	4	1	14.5	31.0	.	.	.	.
9	2	9	6	20	1	7	6	23	3	34	15	33	27	6	2	4.7	11.0	1.4	15	1	7
9	3	9	6	23	1	77	7	3	10	33	28	26	38	6	1	9.4	17.3	3.0	15	2	7
9	4	9	7	3	1	93	7	5	2	54	27	23	27	30	2	11.1	25.1	20.0	16	8	9
9	5	9	7	5	1	132	7	12	7	28	16	20	37	7	2	8.1	13.6	9.8	15	1	1
9	6	9	7	12	1	162	7	19	7	32	9	37	45	7	3	.	.	14.9	15	11	2
10	1	10	6	21	1	-	6	21	.	33	31	22	48	6	5	3.1	6.2	.	.	.	.
10	2	10	6	21	1	55	7	2	11	34	21	26	71	7	2	7.9	8.3	.	.	.	6
10	3	10	7	2	1	84	7	5	3	21	3	3	27	6	1	4.2	7.7	2.0	15	2	9
11	1	11	6	23	2	3	6	23	.	27	9	32	48	6	1	5.0	12.1	.	.	.	.
12	1	12	6	23	2	4	6	23	.	23	15	24	52	2	2	5.6	11.8	.	.	.	.
12	2	12	6	23	2	16	6	25	2	39	2	2	5	14	1	10.2	14.5	6.6	15	1	9
12	3	12	6	25	2	66	7	3	8	24	25	32	52	5	1	4.6	9.5	7.2	16	7	3
13	1	13	6	23	1	5	6	23	.	30	14	12	43	11	2	5.9	12.1	.	.	.	.
13	2	13	6	23	1	20	6	25	2	43	11	23	4	10	2	5.6	8.5	13.9	15	12	9
13	3	13	6	25	1	48	6	27	2	40	3	13	3	21	2	14.2	24.6	4.6	16	6	2

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Mt. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^2)	Light at Surface (lux x 10^3)	Distance Moved (m)	Direction	Angle	Flow Change
13	4	13	6	27	1	92	7	5	8	36	6	12	12	10	1	16.3	26.6	0.8	15	10	4
13	5	13	7	5	1	134	7	12	7	23	9	10	8	8	1	16.1	24.1	2.5	16	6	1
14	1	14	6	23	2	6	6	23	.	25	15	8	35	4	2	7.8	14.8	.	.	.	.
14	2	14	6	23	2	17	6	25	2	26	22	21	38	7	1	11.9	15.2	7.2	15	11	9
14	3	14	6	25	2	75	7	3	8	24	26	24	43	4	2	11.6	22.7	3.4	16	5	3
15	1	15	6	24	1	9	6	24	.	42	20	23	24	10	2	4.3	10.1	.	.	.	.
15	2	15	6	24	1	43	6	27	3	38	10	16	45	7	3	7.9	13.5	8.8	16	5•	2
15	3	15	6	27	1	82	7	3	6	36	19	24	51	4	1	40.0	12.9	6.0	15	1•	6
15	4	15	7	3	1	94	7	5	3	28	5	18	17	11	2	4.4	2.6	2.3	15	2•	9
15	5	15	7	5	1	105	7	8	3	36	18	31	36	11	3	14.6	23.4	1.8	15	11•	2
15	6	15	7	8	1	123	7	10	2	41	18	31	51	8	.	3.9	6.1	0.4	18	9•	6
15	7	15	7	10	1	129	7	12	2	36	14	27	27	17	1	3.4	2.6	0.2	15	12•	9
15	8	15	7	12	1	142	7	15	3	35	12	32	35	10	2	.	.	0.6	16	5•	2
15	9	15	7	15	1	154	7	17	2	28	24	30	28	6	1	.	.	2.2	15	2•	6
15	10	15	7	17	1	165	7	19	2	36	11	25	37	8	3	.	.	3.8	16	7•	8
16	1	16	6	24	1	10	6	24	.	34	16	16	31	9	3	7.5	12.3	.	.	.	.
16	2	16	6	24	1	29	6	26	2	34	10	16	14	24	2	3.2	5.9	15.4	15	1•	3
16	3	16	6	26	1	95	7	5	9	23	2	11	12	6	1	4.9	4.0	14.6	16	6•	9
16	4	16	7	5	1	104	7	8	3	34	12	17	38	6	2	23.1	43.5	4.2	15	11•	2
16	5	16	7	8	1	130	7	12	4	25	7	19	23	11	1	2.7	3.2	3.0	16	5•	4
16	6	16	7	12	1	152	7	17	5	31	30	28	44	9	1	.	.	1.4	16	7•	3
16	7	16	7	17	1	166	7	19	2	33	12	18	25	7	1	.	.	2.0	15	1•	8
17	1	17	6	24	1	11	6	24	.	38	4	23	27	11	3	8.9	18.6	.	.	.	.
17	2	17	6	24	1	22	6	26	2	30	15	16	24	4	4	2.4	1.2	3.2	16	6•	3

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^2)	Light at Surface (lux x 10^5)	Distance Moved (m)	Direction	Angle	Flow Change
17	3	17	6	26	1	41	6	27	1	30	27	20	38	3	7	5.6	11.3	4.0	16	7°	8
17	4	17	6	27	1	82	7	3	6	28	21	32	52	3	1	10.9	6.9	0.8	16	4°	6
17	5	17	7	3	1	121	7	10	7	21	20	16	25	6	.	5.1	4.3	3.6	16	8°	7
17	6	17	7	10	1	141	7	15	5	30	13	23	28	10	2	.	.	7.4	15	1°	8
17	7	17	7	15	1	153	7	17	2	37	19	27	45	7	1	.	.	1.4	16	4°	6
17	8	17	7	17	1	164	7	19	2	35	15	38	31	19	1	.	.	6.4	16	7°	8
18	1	18	6	24	1	12	6	24	.	27	4	32	31	15	6	3.0	7.3	.	.	.	.
19	1	19	6	24	1	13	6	24	.	52	26	32	30	16	2	4.4	11.3	.	.	.	.
20	1	20	6	24	1	14	6	24	.	44	3	33	33	30	2	3.5	4.5	.	.	.	.
20	2	20	6	24	1	88	7	5	11	53	13	4	13	35	1	1.1	4.2	0.4	17	3	1
20	3	20	7	5	1	136	7	15	10	72	22	13	20	52	2	.	.	1.6	17	3	2
21	1	21	6	25	2	15	6	25	.	43	18	24	43	9	1	7.9	15.5	.	.	.	.
22	1	22	6	25	1	21	6	25	.	56	7	15	6	10	2	5.0	12.1	.	.	.	.
22	2	22	6	25	1	199	7	17	22	53	30	40	22	13	1	.	.	4.6	16	6	3
23	1	23	6	26	2	23	6	26	.	22	14	13	14	5	1	3.1	3.2	.	.	.	.
24	1	24	6	26	2	24	6	26	.	38	21	31	48	5	1	2.3	4.0	.	.	.	.
25	1	25	6	26	2	25	6	26	.	34	7	22	43	4	1	3.5	5.0	.	.	.	.
26	1	26	6	26	2	26	6	26	.	29	6	13	17	3	4	3.2	4.0	.	.	.	.
27	1	27	6	26	2	27	6	26	.	46	39	43	54	14	2	7.7	11.8	.	.	.	.
28	1	28	6	26	1	28	6	26	.	49	22	25	17	7	2	2.3	3.1	.	.	.	.
29	1	29	6	27	2	30	6	27	.	20	14	15	34	4	2	18.2	28.3	.	.	.	.
30	1	30	6	27	1	32	6	27	.	13	12	10	13	3	2	23.5	33.7	.	.	.	.
31	1	31	6	27	2	33	6	27	.	29	19	21	53	4	2	17.2	30.4	.	.	.	.
32	1	32	6	27	1	35	6	27	.	33	20	21	72	2	2	13.6	23.5	.	.	.	.

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^3)	Light at Surface (lux x 10^3)	Distance Moved (m)	Direction	Angle	Flow Change
33	1	33	6	27	2	36	6	27	-	36	13	29	66	6	2	16.0	29.3	-	-	-	-
34	1	34	6	27	1	37	6	27	-	31	10	24	40	5	2	12.7	22.5	-	-	-	-
34	2	34	6	27	1	65	7	3	6	28	21	30	42	5	2	3.7	8.1	4.2	16	4	6
35	1	35	6	27	2	38	6	27	-	34	17	17	24	4	2	11.7	18.9	-	-	-	-
35	2	35	6	27	2	90	7	5	8	23	16	20	27	3	1	16.5	28.5	3.4	16	7	4
36	1	36	6	28	1	44	6	28	-	45	17	22	40	11	2	21.8	50.7	-	-	-	-
36	2	36	6	28	1	80	7	3	5	20	14	19	17	3	3	6.9	7.2	9.4	16	6*	6
36	3	36	7	3	1	96	7	5	2	55	26	17	32	13	3	6.1	12.7	12.0	15	12*	9
36	4	36	7	5	1	122	7	10	5	34	10	36	32	18	-	5.3	7.0	10.0	16	7*	3
36	5	36	7	10	1	155	7	17	7	70	11	36	60	8	2	-	-	10.6	15	1*	7
36	6	36	7	17	1	167	7	19	2	48	25	33	41	10	3	-	-	1.0	16	8*	8
37	1	37	6	28	2	45	6	28	-	26	25	25	38	5	3	18.4	33.5	-	-	-	-
38	1	38	6	28	1	46	6	28	-	30	17	26	47	7	3	20.8	27.4	-	-	-	-
38	2	38	6	28	1	103	7	8	10	41	18	31	48	9	3	42.4	97.0	10.6	16	7*	5
38	3	38	7	8	1	143	7	15	7	40	14	33	44	13	2	-	-	2.4	15	12*	5
38	4	38	7	15	1	163	7	19	4	40	27	34	36	11	1	-	-	0.5	16	8*	5
39	1	39	6	28	2	47	6	28	-	34	10	21	39	7	2	20.1	35.7	-	-	-	-
40	1	40	6	28	1	48	6	28	-	43	23	25	46	8	2	12.7	26.7	-	-	-	-
40	2	40	6	28	1	79	7	3	5	33	23	21	44	9	2	53.6	85.9	10.0	16	7*	6
41	1	41	6	28	1	49	6	28	-	34	14	35	18	15	2	4.7	5.5	-	-	-	-
41	2	41	6	28	1	111	7	10	12	37	24	39	16	15	-	2.6	4.5	0.2	18	9	6
41	3	41	7	10	1	151	7	17	7	41	20	25	10	12	1	-	-	5.4	15	1	7
42	1	42	6	28	1	50	6	28	-	25	11	27	37	7	2	1.7	5.0	-	-	-	-
42	2	42	6	28	1	149	7	17	19	28	20	35	21	10	2	-	-	6.8	15	1	6

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^2)	Light at Surface (lux x 10^2)	Distance Moved (m)	Direction	Angle	Flow Change
42	3	42	7	17	1	172	7	19	2	34	22	31	27	11	1	.	.	8.9	15	11	8
43	1	43	6	28	1	51	6	28	.	44	30	22	35	14	2	3.2	9.7	.	.	.	.
43	2	43	6	28	1	124	7	12	14	32	20	24	25	12	2	4.8	6.8	1.2	15	12	4
43	3	43	7	12	1	138	7	15	3	33	16	24	18	12	2	.	.	1.2	16	7	2
43	4	43	7	15	1	150	7	17	2	37	16	21	4	13	2	.	.	5.5	16	6	6
44	1	44	6	28	1	52	6	28	.	40	17	36	25	8	2	4.5	6.9	.	.	.	.
45	1	45	6	28	2	53	6	28	.	39	26	16	56	3	3	4.5	7.2	.	.	.	.
46	1	46	7	2	2	54	7	2	.	45	31	30	48	12	3	2.5	11.7	.	.	.	.
46	2	46	7	2	2	118	7	10	8	28	19	12	35	10	.	8.6	12.9	+50.0	16	6	7
47	1	47	7	2	2	55	7	2	.	43	15	19	39	7	2	33.9	67.3	.	.	.	.
48	1	48	7	2	2	57	7	2	.	55	32	37	43	18	2	12.9	16.0	.	.	.	.
49	1	49	7	2	2	58	7	2	.	34	10	6	52	7	2	49.0	81.8	.	.	.	.
50	1	50	7	2	2	59	7	2	.	42	19	20	30	10	2	4.2	7.2	.	.	.	.
51	1	51	7	2	2	60	7	2	.	43	57	57	66	8	2	45.2	74.5	.	.	.	.
52	1	52	7	2	2	61	7	2	.	55	14	52	57	12	2	39.2	68.9	.	.	.	.
52	2	52	7	2	2	88	7	5	3	40	10	24	41	4	1	6.1	8.8	3.0	16	7*	9
53	1	53	7	2	1	62	7	2	.	49	24	33	25	12	2	6.0	23.2	.	.	.	.
54	1	54	7	2	1	63	7	2	.	41	14	13	22	6	2	14.4	26.9	.	.	.	.
55	1	55	7	2	1	64	7	2	.	41	25	26	29	11	2	20.2	34.7	.	.	.	.
55	2	55	7	2	1	113	7	10	8	36	14	26	25	14	.	8.6	16.6	1.0	17	3	7
55	3	55	7	10	1	171	7	19	9	31	10	22	21	14	3	.	.	17.0	16	8	8
56	1	56	7	3	2	69	7	3	.	28	15	16	42	4	2	4.7	8.2	.	.	.	.
57	1	57	7	3	2	70	7	3	.	25	20	32	63	2	1	10.1	12.5	.	.	.	.
58	1	58	7	3	1	71	7	3	.	30	15	30	69	7	1	11.8	20.3	.	.	.	.

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^0)	Light at Surface (lux x 10^3)	Distance Moved (m)	Direction	Angle	Flow Change
59	1	59	7	3	2	72	7	3	.	28	16	17	46	4	1	7.7	14.1	.	.	.	.
60	1	60	7	3	2	73	7	3	.	30	15	12	44	7	2	4.5	12.0	.	.	.	.
61	1	61	7	3	1	74	7	3	.	25	15	31	42	4	1	6.0	9.7	.	.	.	.
62	1	62	7	3	1	83	7	3	.	48	7	61	66	11	2	40.8	92.2	.	.	.	.
62	2	62	7	3	1	128	7	12	9	36	2	12	26	9	2	3.3	3.6	0.2	15	1°	9
63	1	63	7	5	1	85	7	5	.	30	9	13	22	8	1	5.2	6.8	.	.	.	.
64	1	64	7	5	1	86	7	5	.	47	11	9	51	7	1	6.5	11.3	.	.	.	.
64	2	64	7	5	1	137	7	15	10	54	9	4	54	43	2	.	.	2.8	15	11°	2
65	1	65	7	5	2	87	7	5	.	44	20	39	45	10	2	6.1	8.4	.	.	.	.
65	2	65	7	5	2	117	7	10	5	33	9	19	11	9	.	.	.	9.0	15	2°	3
65	3	65	7	10	2	126	7	12	2	52	0	0	2	15	1	8.5	19.3	13.2	15	1°	9
65	4	65	7	12	2	148	7	17	5	45	23	27	38	5	1	.	.	17.0	16	8°	3
65	5	65	7	17	2	169	7	19	2	37	18	24	32	6	1	.	.	14.8	16	7	8
66	1	66	7	8	2	97	7	8	.	30	14	36	56	2	1	18.6	32.5	.	.	.	.
67	1	67	7	8	2	98	7	8	.	33	10	26	59	5	1	18.0	38.3	.	.	.	.
68	1	68	7	8	2	99	7	9	1	28	21	31	55	4	1	22.5	34.5	.	.	.	.
68	2	68	7	8	2	110	7	9	1	26	14	26	47	4	1	9.7	15.0	1.4	15	2	5
69	1	69	7	8	1	101	7	8	.	28	8	33	63	5	2	14.6	30.9	.	.	.	.
69	2	69	7	8	1	119	7	10	2	28	18	49	55	5	.	9.2	14.7	5.7	16	5	6
69	3	69	7	10	1	146	7	15	5	30	23	26	23	7	1	.	.	5.2	16	6	8
69	4	69	7	15	1	157	7	17	2	41	6	14	10	8	1	.	.	13.8	15	1	6
70	1	70	7	8	1	102	7	8	.	34	8	33	59	5	1	16.8	32.9	.	.	.	.
71	1	71	7	8	1	106	7	8	.	32	4	30	41	12	1	14.0	31.2	.	.	.	.
72	1	72	7	8	2	107	7	8	.	29	20	18	23	7	1	26.0	51.0	.	.	.	.

Table 4 (cont'd)

Fish No.	Capture No.	Tag No.	Month Tagged	Day Tagged	Species	Map No.	Month Recapture	Day Recapture	Days Elapsed	Water Depth (cm)	Nose Velocity ($cm \cdot s^{-1}$)	Lateral Velocity ($cm \cdot s^{-1}$)	Vertical Velocity ($cm \cdot s^{-1}$)	Ht. from Bottom (cm)	Substrate Type	Light at Fish (lux x 10^{3})	Light at Surface (lux x 10^{3})	Distance Moved (m)	Direction	Angle	Flow Change
72	2	72	7	8	2	115	7	10	2	25	15	24	24	7	.	11.3	14.7	5.4	17	3*	6
72	3	72	7	10	2	125	7	12	2	22	12	10	12	10	1	7.3	15.4	6.0	16	8*	9
72	4	72	7	12	2	140	7	15	3	58	11	30	39	9	2	.	.	5.4	18	9*	2
72	5	72	7	15	2	146	7	17	2	83	13	26	47	12	2	.	.	3.5	16	8*	6
72	6	72	7	17	2	168	7	19	2	56	24	33	46	7	1	.	.	2.7	16	4*	8
73	1	73	7	8	2	108	7	8	.	52	5	35	40	10	1	15.5	33.8	.	.	.	.
74	1	74	7	8	2	109	7	8	.	38	33	45	57	5	2	19.7	32.3	.	.	.	.
75	1	75	7	10	1	112	7	10	.	32	31	34	52	7	.	5.4	13.4	.	.	.	.
76	1	76	7	10	1	114	7	10	.	40	20	36	49	8	.	7.0	15.1	.	.	.	.
77	1	77	7	12	1	135	7	12	.	52	10	15	35	9	1	.	.	.	.	.	.
77	2	77	7	12	1	158	7	17	5	45	9	10	9	10	1	.	.	5.1	17	3	3
77	3	77	7	17	1	161	7	19	3	52	24	43	22	25	1	.	.	13.4	15	11	8

* = Reverse clock

Table 5. Kloiya Creek microhabitat study 1985. Length and weight at tagging, and pool number for each individual coho and chinook salmon at tagging and recapture.

Year	Fish No.	Wt(gm.) Tagging	Len(mm.) Tagging	Month Tagged	Day Tagged	Species	Pool No. Tagging	Month Recapture	Day Recapture	Pool No. Recapture	Tag No.	Tag Colour
85	1	1.6	53	6	18	Coho	3	.	.	.	1	White-1-Blue
85	2	1.3	51	6	19	Coho	3	6	27	1	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	3	1	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	10	3	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	12	3	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	15	3	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	17	3	2	White-2-Blue
85	2	.	.	.	.	Coho	.	7	19	3	2	White-2-Blue
85	3	2.3	59	6	19	Chinook	1	6	27	1	3	White-3-Blue
85	3	.	.	.	.	Chinook	.	7	3	1	3	White-3-Blue
85	4	1.2	51	6	19	Coho	1	7	3	1	4	White-4-Blue
85	4	.	.	.	.	Coho	.	7	12	1	4	White-4-Blue
85	5	1.8	56	6	19	Chinook	1	6	23	1	5	White-5-Blue
85	5	.	.	.	.	Chinook	.	6	25	1	5	White-5-Blue
85	5	.	.	.	.	Chinook	.	6	27	1	5	White-5-Blue
85	6	1.7	55	6	19	Coho	1	6	27	2	6	White-1-Red
85	7	1.9	53	6	19	Chinook	1	.	.	.	7	White-2-Red
85	8	1.7	53	6	20	Coho	1	6	25	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	3	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	5	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	8	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	10	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	12	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	15	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	17	1	8	White-3-Red
85	8	.	.	.	.	Coho	.	7	19	1	8	White-3-Red
85	9	1.9	55	6	20	Coho	1	6	23	1	9	White-4-Red
85	9	.	.	.	.	Coho	.	7	3	1	9	White-4-Red
85	9	.	.	.	.	Coho	.	7	5	1	9	White-4-Red
85	9	.	.	.	.	Coho	.	7	12	1	9	White-4-Red
85	9	.	.	.	.	Coho	.	7	19	1	9	White-4-Red
85	10	1.2	50	6	21	Coho	3	7	2	3	10	White-5-Red
85	10	.	.	.	.	Coho	.	7	5	3	10	White-5-Red
85	11	1.5	50	6	23	Chinook	1	.	.	.	11	Blue-1-White
85	12	1.5	52	6	23	Chinook	1	6	25	1	12	Blue-3-White
85	12	.	.	.	.	Chinook	.	7	3	1	12	Blue-3-White
85	13	1.2	49	6	23	Coho	1	6	25	1	13	Blue-4-White
85	13	.	.	.	.	Coho	.	6	27	1	13	Blue-4-White
85	13	.	.	.	.	Coho	.	7	5	1	13	Blue-4-White
85	13	.	.	.	.	Coho	.	7	12	1	13	Blue-4-White
85	14	1.8	55	6	23	Chinook	1	6	25	1	14	Blue-5-White
85	14	.	.	.	.	Chinook	.	7	3	1	14	Blue-5-White
85	15	1.9	56	6	24	Coho	2	6	27	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	3	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	5	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	8	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	10	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	12	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	15	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	17	2	15	Blue-2-White
85	15	.	.	.	.	Coho	.	7	19	2	15	Blue-2-White

Table 5 (cont'd)

Year	Fish No.	Wt(gm.) Tagging	Len(mm.) Tagging	Month Tagged	Day Tagged	Species	Pool No. Tagging	Month Recapture	Day Recapture	Pool No. Recapture	Tag No.	Tag Colour
85	16	1.7	56	6	24	Coho	2	6	26	2	16	Red-1-White
85	16	.	.	.	.	Coho	.	7	5	2	16	Red-1-White
85	16	.	.	.	.	Coho	.	7	8	2	16	Red-1-White
85	16	.	.	.	.	Coho	.	7	12	2	16	Red-1-White
85	16	.	.	.	.	Coho	.	7	17	2	16	Red-1-White
85	17	1.5	51	6	24	Coho	2	6	26	2	16	Red-1-White
85	17	.	.	.	.	Coho	.	6	27	2	17	Red-2-White
85	17	.	.	.	.	Coho	.	7	3	2	17	Red-2-White
85	17	.	.	.	.	Coho	.	7	10	2	17	Red-2-White
85	17	.	.	.	.	Coho	.	7	15	2	17	Red-2-White
85	17	.	.	.	.	Coho	.	7	17	2	17	Red-2-White
85	18	1.2	48	6	24	Coho	5	.	.	.	18	Red-3-White
85	19	7.7	89	6	24	Coho	3	.	.	.	19	Red-4-White
85	20	2.0	57	6	24	Coho	3	7	5	3	20	Red-5-White
85	20	.	.	.	.	Coho	.	7	15	3	20	Red-5-White
85	21	2.1	58	6	25	Chinook	1	.	.	.	21	Blue-1-Yellow
85	22	2.2	59	6	25	Coho	1	7	17	1	22	Blue-2-Yellow
85	23	1.4	51	6	26	Chinook	2	.	.	.	23	Blue-3-Yellow
85	24	1.8	55	6	26	Chinook	2	.	.	.	24	Blue-4-Yellow
85	25	1.8	55	6	26	Chinook	2	.	.	.	25	Blue-5-Yellow
85	26	1.2	49	6	26	Chinook	2	.	.	.	26	Yellow-1-Red
85	27	2.8	63	6	26	Chinook	2	.	.	.	27	Yellow-2-Red
85	28	1.5	52	6	26	Coho	2	.	.	.	28	Yellow-3-Red
85	29	1.5	52	6	27	Chinook	1	.	.	.	29	Yellow-4-Red
85	30	1.4	50	6	27	Coho	1	.	.	.	30	Yellow-5-Red
85	31	1.8	52	6	27	Chinook	1	.	.	.	31	Yellow-1-Blue
85	32	2.3	60	6	27	Coho	1	.	.	.	32	Yellow-2-Blue
85	33	1.4	51	6	27	Chinook	1	.	.	.	33	Yellow-3-Blue
85	34	1.4	52	6	27	Coho	1	7	3	1	34	Yellow-5-Blue
85	35	1.7	55	6	27	Chinook	1	7	5	1	35	Yellow-4-Blue
85	36	2.9	61	6	28	Coho	2	7	3	2	36	Yellow-Red-Blue
85	36	.	.	.	.	Coho	.	7	5	2	36	Yellow-Red-Blue
85	36	.	.	.	.	Coho	.	7	10	2	36	Yellow-Red-Blue
85	36	.	.	.	.	Coho	.	7	17	2	36	Yellow-Red-Blue
85	36	.	.	.	.	Coho	.	7	19	2	36	Yellow-Red-Blue
85	37	1.6	53	6	28	Chinook	2	.	.	.	37	Yellow-Blue-Red
85	38	2.1	59	6	28	Coho	2	7	8	2	38	Blue-Yellow-Red
85	38	.	.	.	.	Coho	.	7	15	2	38	Blue-Yellow-Red
85	38	.	.	.	.	Coho	.	7	19	2	38	Blue-Yellow-Red
85	39	2.8	64	6	28	Chinook	2	.	.	.	39	White-Red-Blue
85	40	3.2	67	6	28	Coho	2	7	3	2	40	Blue-White-Red
85	41	2.6	63	6	28	Coho	5	7	10	5	41	Red-Blue-White
85	41	.	.	.	.	Coho	.	7	17	5	41	Red-Blue-White
85	42	1.6	54	6	28	Coho	5	7	17	5	42	White
85	42	.	.	.	.	Coho	.	7	19	5	42	White
85	43	2.0	58	6	28	Coho	5	7	12	5	43	Red
85	43	.	.	.	.	Coho	.	7	15	5	43	Red
85	43	.	.	.	.	Coho	.	7	17	5	43	Red

Table 5 (cont'd)

Year	Fish No.	Wt(gm.) Tagging	Len(mm.) Tagging	Month Tagged	Day Tagged	Species	Pool No. Tagging	Month Recapture	Day Recapture	Pool No. Recapture	Tag No.	Tag Colour
85	44	1.3	50	6	28	Coho	5	.	.	.	44	Blue
85	45	1.2	50	6	28	Chinook	5	.	.	.	45	Yellow
85	46	1.5	52	7	2	Chinook	3	7	10	1	46	Black
85	47	1.3	50	7	2	Chinook	3	.	.	.	47	Black-1-White
85	48	1.4	52	7	2	Chinook	3	.	.	.	48	Black-2-White
85	49	1.2	49	7	2	Chinook	3	.	.	.	49	Black-3-White
85	50	1.2	49	7	2	Chinook	3	.	.	.	50	Black-4-White
85	51	2.2	58	7	2	Chinook	3	.	.	.	51	Black-5-White
85	52	1.7	56	7	2	Chinook	3	7	5	3	52	Black-1-Red
85	53	1.3	50	7	2	Coho	3	.	.	.	53	Black-2-Red
85	54	1.4	51	7	2	Coho	3	.	.	.	54	Black-3-Red
85	55	1.5	53	7	2	Coho	3	7	10	3	55	Black-4-Red
85	55	.	.	.	.	Coho	.	7	19	3	55	Black-4-Red
85	56	1.8	56	7	3	Chinook	1	.	.	.	56	Black-5-Red
85	57	1.7	55	7	3	Chinook	1	.	.	.	57	Black-1-Yellow
85	58	1.3	50	7	3	Coho	1	.	.	.	58	Black-2-Yellow
85	59	1.8	56	7	3	Chinook	1	.	.	.	59	Black-3-Yellow
85	60	1.8	57	7	3	Chinook	1	.	.	.	60	Black-4-Yellow
85	61	1.4	51	7	3	Coho	1	.	.	.	61	Black-5-Yellow
85	62	1.8	54	7	3	Coho	2	7	12	2	62	Black-1-Blue
85	63	2.8	64	7	5	Coho	3	.	.	.	63	Black-2-Blue
85	64	2.7	60	7	5	Coho	3	7	15	3	64	Black-3-Blue
85	65	1.6	53	7	5	Chinook	3	7	10	3	65	Black-4-Blue
85	65	.	.	.	.	Chinook	.	7	12	3	65	Black-4-Blue
85	65	.	.	.	.	Chinook	.	7	17	3	65	Black-4-Blue
85	65	.	.	.	.	Chinook	.	7	19	3	65	Black-4-Blue
85	66	1.4	52	7	8	Chinook	1	.	.	.	66	Black-5-Blue
85	67	1.3	51	7	8	Chinook	1	.	.	.	67	Black-1-Green
85	68	1.4	53	7	8	Chinook	1	7	9	1	68	Black-2-Green
85	69	1.9	57	7	8	Coho	1	7	10	1	69	Black-3-Green
85	69	.	.	.	.	Coho	.	7	15	1	69	Black-3-Green
85	69	.	.	.	.	Coho	.	7	17	1	69	Black-3-Green
85	70	1.6	55	7	8	Coho	1	.	.	.	70	Black-4-Green
85	71	1.3	50	7	8	Coho	2	.	.	.	71	Black-5-Green
85	72	1.6	57	7	8	Chinook	3	7	10	3	72	Green
85	72	.	.	.	.	Chinook	.	7	12	3	72	Green
85	72	.	.	.	.	Chinook	.	7	15	3	72	Green
85	72	.	.	.	.	Chinook	.	7	17	3	72	Green
85	72	.	.	.	.	Chinook	.	7	19	3	72	Green
85	73	1.5	53	7	8	Chinook	3	.	.	.	73	Green-1-White
85	74	1.1	50	7	8	Chinook	3	.	.	.	74	Green-2-White
85	75	1.2	49	7	10	Coho	3	.	.	.	75	Green-3-White
85	76	1.5	53	7	10	Coho	3	.	.	.	76	Green-4-White
85	77	2.3	60	7	12	Coho	1	7	17	1	77	Green-5-White
85	77	.	.	.	.	Coho	.	7	19	1	77	Green-5-White

Table 6. Kloiya Creek microhabitat study 1985. The distance moved, at each recapture, from the original tagging location by juvenile coho and chinook salmon in Kloiya Creek.

Species	Fish No.	Tagging			Recapture				
		Location	Date	Stream flow	Location	Date	Stream flow	Recapture No.	Distance moved (m)
Coho	2	39	June 27	Normal	78	July 3	Flood	1	4.6
					116	July 10	Flood	2	+50.0
					127	July 12	Drought	3	41.4
					139	July 15	Normal	4	53.4
					147	July 17	Flood	5	47.6
					170	July 19	Normal	6	54.4
Coho	4	76	July 3	Flood	133	July 12	Drought	1	5.0
Coho	8	1	June 20	Flood	18	June 25	Drought	1	3.8
					67	July 3	Flood	2	6.0
					91	July 5	Drought	3	2.8
					100	July 8	Normal	4	2.6
					120	July 10	Flood	5	9.8
					131	July 12	Drought	6	2.7
					144	July 15	Normal	7	15.5
					156	July 17	Flood	8	8.2
					160	July 19	Normal	9	1.8
Coho	9	2	June 20	Flood	7	June 23	Flood	1	14.0
					77	July 3	Flood	2	4.2
					93	July 5	Drought	3	15.9
					132	July 12	Drought	4	8.7
					162	July 19	Normal	5	21.9
Coho	10	55	July 2	Flood	84	July 5	Drought	1	2.0
Coho	13	5	June 23	Flood	20	June 25	Drought	1	13.8
					40	June 27	Normal	2	9.2
					92	July 5	Drought	3	9.8
					134	July 12	Drought	4	7.4
Coho	15	9	June 24	Drought	43	June 27	Normal	1	8.8
					82	July 3	Flood	2	4.7
					94	July 5	Drought	3	6.2
					105	July 8	Normal	4	5.2
					123	July 10	Flood	5	4.8
					129	July 12	Drought	6	4.7
					142	July 15	Normal	7	5.0
					154	July 17	Flood	8	7.3
					165	July 19	Normal	9	4.6

Table 6 (cont'd)

Species	Fish No.	Tagging			Recapture				
		Location	Date	Stream flow	Location	Date	Stream flow	Recapture No.	Distance moved (m)
Coho	16	10	June 24	Drought	29	June 26	Flood	1	15.5
					95	July 5	Drought	2	5.0
					104	July 8	Normal	3	3.5
					130	July 12	Drought	4	3.5
					152	July 17	Flood	5	3.2
					166	July 19	Normal	6	3.8
Coho	17	11	June 24	Drought	22	June 26	Flood	1	3.3
					41	June 27	Normal	2	5.7
					81	July 3	Flood	3	6.2
					121	July 10	Flood	4	7.0
					141	July 15	Normal	5	2.4
					153	July 17	Flood	6	3.8
					164	July 19	Normal	7	6.2
Coho	20	14	June 24	Drought	89	July 5	Drought	1	0.4
					136	July 15	Normal	2	2.0
Coho	22	21	June 25	Drought	159	July 17	Flood	1	4.6
Coho	34	37	June 27	Normal	65	July 3	Flood	1	4.4
Coho	36	44	June 28	Normal	80	July 3	Flood	1	9.4
					96	July 5	Drought	2	3.2
					122	July 10	Flood	3	7.0
					155	July 17	Flood	4	3.9
					167	July 19	Normal	5	3.4
Coho	38	46	June 28	Normal	103	July 8	Normal	1	10.6
					143	July 15	Normal	2	8.2
					163	July 19	Normal	3	8.7
Coho	40	48	June 28	Normal	79	July 3	Flood	1	10.0
Coho	41	49	June 28	Normal	111	July 10	Flood	1	0.3
					151	July 17	Flood	2	5.3
Coho	42	50	June 28	Normal	149	July 17	Flood	1	6.8
					172	July 19	Normal	2	15.2

Table 6 (cont'd)

Species	Fish No.	Tagging			Recapture				
		Location	Date	Stream flow	Location	Date	Stream flow	Recapture No.	Distance moved (m)
Coho	43	51	June 28	Normal	124	July 12	Drought	1	1.2
					138	July 15	Normal	2	0.8
					150	July 17	Flood	3	5.4
Coho	55	64	July 2	Flood	113	July 10	Flood	1	1.1
					171	July 19	Normal	2	16.4
Coho	62	83	July 3	Flood	128	July 12	Drought	1	0.2
Coho	64	86	July 5	Drought	137	July 15	Normal	1	2.7
Coho	69	101	July 8	Normal	119	July 10	Flood	1	5.8
					145	July 15	Normal	2	10.6
					157	July 17	Flood	3	6.9
Coho	77	135	July 12	Drought	158	July 17	Flood	1	5.1
					161	July 19	Normal	2	10.8
Chinook	3	31	June 27	Normal	68	July 3	Flood	1	1.8
Chinook	5	8	June 23	Flood	19	June 25	Drought	1	5.1
					34	June 27	Normal	2	2.1
Chinook	12	4	June 23	Flood	16	June 25	Drought	1	6.8
					66	July 3	Flood	2	0.5
Chinook	14	6	June 23	Flood	17	June 25	Drought	1	7.3
					75	July 3	Flood	2	3.9
Chinook	35	38	June 27	Normal	90	July 5	Drought	1	3.5
Chinook	46	54	July 2	Flood	118	July 10	Flood	1	+50.0
Chinook	52	61	July 2	Flood	88	July 5	Drought	1	3.2

Table 6 (cont'd)

Species	Fish No.	Tagging			Recapture				
		Location	Date	Stream flow	Location	Date	Stream flow	Recapture No.	Distance moved (m)
Chinook	65	87	July 5	Drought	117	July 10	Flood	1	11.0
					126	July 12	Drought	2	22.0
					148	July 17	Flood	3	14.4
					169	July 19	Normal	4	4.1
Chinook	68	99	July 8	Normal	110	July 9	Normal	1	2.0
Chinook	72	107	July 8	Normal	115	July 10	Flood	1	5.4
					125	July 12	Drought	2	3.6
					140	July 15	Normal	3	6.0
					146	July 17	Flood	4	9.4
					168	July 19	Normal	5	8.6

Table 7. Kloiya Creek microhabitat study 1985. The mean distance moved, by streamflow change, from the original tagging location for juvenile coho and chinook salmon in Kloiya Creek.

Drought to Drought Streamflow Change

Species	Fish No.	Tagging Location	Date	Stream flow	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Coho	15	9	June 24	Drought	94	July 5	Drought	3	6.2
Coho	15	9	June 24	Drought	129	July 12	Drought	6	4.7
Coho	16	10	June 24	Drought	95	July 5	Drought	2	5.0
Coho	16	10	June 24	Drought	130	July 12	Drought	4	3.5
Coho	20	14	June 24	Drought	89	July 5	Drought	1	0.4
			N = 5		$\bar{X}$ = 3.96 ± 2.21 m				
Chinook	65	87	July 5	Drought	126	July 12	Drought	2	22.0
			N = 1		$\bar{X}$ = 22.0 m				

Drought to Normal Streamflow Change

Coho	15	9	June 24	Drought	43	June 27	Normal	1	8.0
Coho	15	9	June 24	Drought	105	July 8	Normal	4	5.2
Coho	15	9	June 24	Drought	142	July 15	Normal	7	5.0
Coho	15	9	June 24	Drought	165	July 19	Normal	9	4.6
Coho	16	10	June 24	Drought	104	July 8	Normal	3	3.5
Coho	16	10	June 24	Drought	166	July 19	Normal	6	3.8
Coho	17	11	June 24	Drought	41	June 27	Normal	2	5.7
Coho	17	11	June 24	Drought	141	July 15	Normal	5	2.4
Coho	17	11	June 24	Drought	164	July 19	Normal	7	6.2
Coho	20	14	June 24	Drought	136	July 15	Normal	2	2.0
Coho	64	86	July 5	Drought	137	July 15	Normal	1	2.7
Coho	77	135	July 12	Drought	161	July 19	Normal	2	10.8
			N = 12		$\bar{X}$ = 5.06 ± 2.61 m				
Chinook	65	87	July 5	Drought	169	July 19	Normal	4	4.1
			N = 1		$\bar{X}$ = 4.1 m				

Drought to Flood Streamflow Change

Coho	15	9	June 24	Drought	82	July 3	Flood	2	4.7
Coho	15	9	June 24	Drought	123	July 10	Flood	5	4.8
Coho	15	9	June 24	Drought	154	July 17	Flood	8	7.3
Coho	16	10	June 24	Drought	29	June 26	Flood	1	15.5
Coho	16	10	June 24	Drought	152	July 17	Flood	5	3.2
Coho	17	11	June 24	Drought	22	June 26	Flood	1	3.3
Coho	17	11	June 24	Drought	81	July 3	Flood	3	6.2
Coho	17	11	June 24	Drought	121	July 10	Flood	4	7.0
Coho	17	11	June 24	Drought	153	July 17	Flood	6	3.8
Coho	22	21	June 25	Drought	159	July 17	Flood	1	4.6
Coho	77	135	July 12	Drought	158	July 17	Flood	1	5.1
			N = 11		$\bar{X}$ = 5.95 ± 3.45 m				
Chinook	65	87	July 5	Drought	117	July 10	Flood	1	11.0
Chinook	65	87	July 5	Drought	148	July 17	Flood	3	14.4
			N = 2		$\bar{X}$ = 12.70 ± 2.40 m				

Table 7 (cont'd)

Normal to Drought Streamflow Change

Species	Fish No.	Tagging Location	Date	Stream flow	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Coho	2	39	June 27	Normal	127	July 12	Drought	3	41.4
Coho	36	44	June 28	Normal	96	July 5	Drought	2	3.2
Coho	43	51	June 28	Normal	124	July 12	Drought	1	1.2
			N = 3		$\bar{X}$ = 15.27 ± 22.65 m				
Chinook	35	38	June 27	Normal	90	July 5	Drought	1	3.5
Chinook	72	107	July 8	Normal	125	July 12	Drought	2	3.6
			N = 2		$\bar{X}$ = 3.55 ± 0.07 m				

Normal to Normal Streamflow Change

Coho	2	39	June 27	Normal	139	July 15	Normal	4	53.4
Coho	2	39	June 27	Normal	170	July 19	Normal	6	54.4
Coho	36	44	June 28	Normal	167	July 19	Normal	5	3.4
Coho	38	46	June 28	Normal	103	July 8	Normal	1	10.6
Coho	38	46	June 28	Normal	143	July 15	Normal	2	8.2
Coho	38	46	June 28	Normal	163	July 19	Normal	3	8.7
Coho	42	50	June 28	Normal	172	July 19	Normal	2	15.2
Coho	43	51	June 28	Normal	138	July 15	Normal	2	0.8
Coho	69	101	July 8	Normal	145	July 15	Normal	2	10.6
			N = 9		$\bar{X}$ = 18.37 ± 20.57 m				

Normal to Flood Streamflow Change

Coho	2	39	June 27	Normal	78	July 3	Flood	1	4.6
Coho	2	39	June 27	Normal	116	July 10	Flood	2	+50.0
Coho	2	39	June 27	Normal	147	July 17	Flood	5	47.6
Coho	34	37	June 27	Normal	65	July 3	Flood	1	4.4
Coho	36	44	June 28	Normal	80	July 3	Flood	1	9.4
Coho	36	44	June 28	Normal	122	July 10	Flood	3	7.0
Coho	36	44	June 28	Normal	155	July 17	Flood	4	3.9
Coho	40	48	June 28	Normal	79	July 3	Flood	1	10.0
Coho	41	49	June 28	Normal	111	July 10	Flood	1	0.3
Coho	41	49	June 28	Normal	151	July 17	Flood	2	5.3
Coho	42	50	June 28	Normal	149	July 17	Flood	1	6.8
Coho	43	51	June 28	Normal	150	July 17	Flood	3	5.4
Coho	69	101	July 8	Normal	119	July 10	Flood	1	5.8
Coho	69	101	July 8	Normal	157	July 17	Flood	3	6.9
			N = 14		$\bar{X}$ = 11.96 ± 15.79 m				
Chinook	3	31	June 27	Normal	68	July 3	Flood	1	1.8
Chinook	72	107	July 8	Normal	115	July 10	Flood	1	5.4
Chinook	72	107	July 8	Normal	146	July 17	Flood	4	9.4
			N = 3		$\bar{X}$ = 5.53 ± 3.80 m				

Table 7 (cont'd)

Flood to Drought Streamflow Change

Species	Fish No.	Tagging Location	Date	Stream flow	Recapture Location	Date	Stream flow	Recapture no.	Distance (m)
Coho	4	76	July 3	Flood	133	July 12	Drought	1	5.0
Coho	8	1	June 20	Flood	18	June 25	Drought	1	3.8
Coho	8	1	June 20	Flood	91	July 5	Drought	3	2.8
Coho	8	1	June 20	Flood	131	July 12	Drought	6	2.7
Coho	9	2	June 20	Flood	93	July 5	Drought	3	15.9
Coho	9	2	June 20	Flood	132	July 12	Drought	4	8.7
Coho	10	55	July 2	Flood	84	July 5	Drought	1	2.0
Coho	13	5	June 23	Flood	20	June 25	Drought	1	13.8
Coho	13	5	June 23	Flood	92	July 5	Drought	3	9.8
Coho	13	5	June 23	Flood	134	July 12	Drought	4	7.4
Coho	62	83	July 3	Flood	128	July 12	Drought	1	0.2
			N = 11		$\bar{X}$ = 6.55 ± 5.06 m				
Chinook	5	8	June 23	Flood	19	June 25	Drought	1	5.1
Chinook	12	4	June 23	Flood	16	June 25	Drought	1	6.8
Chinook	14	6	June 23	Flood	17	June 25	Drought	1	7.3
Chinook	52	61	July 2	Flood	88	July 5	Drought	1	3.2
			N = 4		$\bar{X}$ = 5.60 ± 1.86 m				

Flood to Normal Streamflow Change

Species	Fish No.	Tagging Location	Date	Stream flow	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Coho	8	1	June 20	Flood	100	July 8	Normal	4	2.6
Coho	8	1	June 20	Flood	144	July 15	Normal	7	15.5
Coho	8	1	June 20	Flood	160	July 19	Normal	9	1.8
Coho	9	2	June 20	Flood	162	July 19	Normal	5	21.9
Coho	13	5	June 23	Flood	40	June 27	Normal	2	9.2
Coho	55	64	July 2	Flood	171	July 19	Normal	2	16.4
			N = 6		$\bar{X}$ = 11.23 ± 8.08 m				
Chinook	5	8	June 23	Flood	34	June 27	Normal	2	2.1
			N = 1		$\bar{X}$ = 2.1 m				

Flood to Flood Streamflow Change

Coho	8	1	June 20	Flood	67	July 3	Flood	2	6.0
Coho	8	1	June 20	Flood	120	July 10	Flood	5	9.8
Coho	8	1	June 20	Flood	156	July 17	Flood	8	8.2
Coho	9	2	June 20	Flood	7	June 23	Flood	1	14.0
Coho	9	2	June 20	Flood	77	July 3	Flood	2	4.2
Coho	55	64	July 2	Flood	113	July 10	Flood	1	1.1
			N = 6		$\bar{X}$ = 7.22 ± 4.51 m				
Chinook	12	4	June 23	Flood	66	July 3	Flood	2	0.5
Chinook	14	6	June 23	Flood	75	July 3	Flood	2	3.9
Chinook	46	54	July 2	Flood	118	July 10	Flood	1	+50.0
			N = 3		$\bar{X}$ = 18.13 ± 27.65 m				

Table 8. Kloiya Creek microhabitat study 1985. The distance moved, between recaptures, from the last location by juvenile coho and chinook salmon in Kloiya Creek.

Species	Fish No.	Capture Location	Date	Stream flow	Capture No.	Distance (m)	Streamflow Change
Coho	2	-	June 19	Flood	1	-	-
		39	June 27	Normal	2	-	-
		78	July 3	Flood	3	4.6	Normal to Flood
		116	July 10	Flood	4	+50.0	Flood to Flood
		127	July 12	Drought	5	8.6	Flood to Drought
		139	July 15	Normal	6	12.8	Drought to Normal
		147	July 17	Flood	7	13.9	Normal to Flood
		170	July 19	Normal	8	12.5	Flood to Normal
Coho	4	-	June 19	Flood	1	-	-
		76	July 3	Flood	2	-	Flood to Flood
		133	July 12	Drought	3	5.0	Flood to Drought
Coho	8	1	June 20	Flood	1	-	-
		18	June 25	Drought	2	3.8	Flood to Drought
		67	July 3	Flood	3	9.6	Drought to Flood
		91	July 5	Drought	4	8.5	Flood to Drought
		100	July 8	Normal	5	0.4	Drought to Normal
		120	July 10	Flood	6	12.0	Normal to Flood
		131	July 12	Drought	7	12.0	Flood to Drought
		144	July 15	Normal	8	17.8	Drought to Normal
		156	July 17	Flood	9	10.4	Normal to Flood
		160	July 19	Normal	10	10.0	Flood to Normal
Coho	9	2	June 20	Flood	1	-	-
		7	June 23	Flood	2	1.4	Flood to Flood
		77	July 3	Flood	3	3.0	Flood to Flood
		93	July 5	Drought	4	20.0	Flood to Drought
		132	July 12	Drought	5	9.8	Drought to Drought
		162	July 19	Normal	6	14.9	Drought to Normal
Coho	10	2	June 21	Normal	1	-	-
		55	July 2	Flood	2	-	Normal to Flood
		84	July 5	Drought	3	2.0	Flood to Drought
Coho	13	5	June 23	Flood	1	-	-
		20	June 25	Drought	2	13.9	Flood to Drought
		40	June 27	Normal	3	4.6	Drought to Normal
		92	July 5	Drought	4	0.8	Normal to Drought
		134	July 12	Drought	5	2.5	Drought to Drought
Coho	15	9	June 24	Drought	1	-	-
		43	June 27	Normal	2	8.8	Drought to Normal
		82	July 3	Flood	3	6.0	Normal to Flood
		94	July 5	Drought	4	2.3	Flood to Drought
		105	July 8	Normal	5	1.8	Drought to Normal
		123	July 10	Flood	6	0.4	Normal to Flood
		129	July 12	Drought	7	0.2	Flood to Drought
		142	July 15	Normal	8	0.6	Drought to Normal
		154	July 17	Flood	9	2.2	Normal to Flood
		165	July 19	Normal	10	3.8	Flood to Normal

Table 8 (cont'd)

Species	Fish No.	Capture Location	Date	Stream flow	Capture No.	Distance (m)	Streamflow Change
Coho	16	10	June 24	Drought	1	-	-
		29	June 26	Flood	2	15.4	Drought to Flood
		95	July 5	Drought	3	14.6	Flood to Drought
		104	July 8	Normal	4	4.2	Drought to Normal
		130	July 12	Drought	5	3.0	Normal to Drought
		152	July 17	Flood	6	1.4	Drought to Flood
		166	July 19	Normal	7	2.0	Flood to Normal
Coho	17	11	June 24	Drought	1	-	-
		22	June 26	Flood	2	3.2	Drought to Flood
		41	June 27	Normal	3	4.0	Flood to Normal
		81	July 3	Flood	4	0.8	Normal to Flood
		121	July 10	Flood	5	3.6	Flood to Flood
		141	July 15	Normal	6	7.4	Flood to Normal
		153	July 17	Flood	7	1.4	Normal to Flood
		164	July 19	Normal	8	6.4	Flood to Normal
Coho	20	14	June 24	Drought	1	-	-
		89	July 5	Drought	2	0.4	Drought to Drought
		136	July 15	Normal	3	1.6	Drought to Normal
Coho	22	21	June 25	Drought	1	-	-
		159	July 17	Flood	2	4.6	Drought to Flood
Coho	34	37	June 27	Normal	1	-	-
		65	July 3	Flood	2	4.2	Normal to Flood
Coho	36	44	June 28	Normal	1	-	-
		80	July 3	Flood	2	9.4	Normal to Flood
		96	July 5	Drought	3	12.0	Flood to Drought
		122	July 10	Flood	4	10.0	Drought to Flood
		155	July 17	Flood	5	10.6	Flood to Flood
		167	July 19	Normal	6	1.0	Flood to Normal
Coho	38	46	June 28	Normal	1	-	-
		103	July 8	Normal	2	10.6	Normal to Normal
		143	July 15	Normal	3	2.4	Normal to Normal
		163	July 19	Normal	4	0.5	Normal to Normal
Coho	40	48	June 28	Normal	1	-	-
		79	July 3	Flood	2	10.0	Normal to Flood
Coho	41	49	June 28	Normal	1	-	-
		111	July 10	Flood	2	0.2	Normal to Flood
		151	July 17	Flood	3	5.4	Normal to Flood
Coho	42	50	June 28	Normal	1	-	-
		149	July 17	Flood	2	6.8	Normal to Flood
		172	July 19	Normal	3	8.9	Flood to Normal
Coho	43	51	June 28	Normal	1	-	-
		124	July 12	Drought	2	1.2	Normal to Drought
		138	July 15	Normal	3	1.2	Drought to Normal
		150	July 17	Flood	4	5.5	Normal to Flood

Table 8 (cont'd)

Species	Fish No.	Capture Location	Date	Stream flow	Capture No.	Distance (m)	Streamflow Change
Coho	55	64	July 2	Flood	1	-	-
		113	July 10	Flood	2	1.0	Flood to Flood
		171	July 19	Flood	3	17.0	Flood to Normal
Coho	62	83	July 3	Flood	1	-	-
		128	July 12	Drought	2	0.2	Flood to Drought
Coho	64	86	July 5	Drought	1	-	-
		137	July 15	Normal	2	2.8	Drought to Normal
Coho	69	101	July 8	Normal	1	-	-
		119	July 10	Flood	2	5.7	Normal to Flood
		145	July 15	Normal	3	5.2	Flood to Normal
		157	July 17	Flood	4	13.8	Normal to Flood
Coho	77	135	July 12	Drought	1	-	-
		158	July 17	Flood	2	5.1	Drought to Flood
		161	July 19	Normal	3	13.4	Flood to Normal
Chinook	3	-	June 19	Flood	1	-	-
		31	June 27	Normal	2	-	Flood to Normal
		68	July 3	Flood	3	1.8	Normal to Flood
Chinook	5	8	June 23	Flood	1	-	-
		19	June 25	Drought	2	5.0	Flood to Drought
		34	June 27	Normal	3	5.6	Drought to Normal
Chinook	12	4	June 23	Flood	1	-	-
		16	June 25	Drought	2	6.6	Flood to Drought
		66	July 3	Flood	3	7.2	Drought to Flood
Chinook	14	6	June 23	Flood	1	-	-
		17	June 25	Drought	2	7.2	Flood to Drought
		75	July 3	Flood	3	3.4	Drought to Flood
Chinook	35	38	June 27	Normal	1	-	-
		90	July 5	Drought	2	3.4	Normal to Drought
Chinook	46	54	July 2	Flood	1	-	-
		118	July 10	Flood	2	+50.0	Flood to Flood
Chinook	52	61	July 2	Flood	1	-	-
		86	July 5	Drought	2	3.0	Flood to Drought
Chinook	65	87	July 5	Drought	1	-	-
		117	July 10	Flood	2	9.0	Drought to Flood
		126	July 12	Drought	3	13.2	Flood to Drought
		148	July 17	Flood	4	17.0	Drought to Flood
		169	July 19	Normal	5	14.8	Flood to Normal
Chinook	68	99	July 8	Normal	1	-	-
		110	July 9	Normal	2	1.4	Normal to Normal

Table 8 (cont'd)

Species	Fish No.	Capture Location	Date	Stream flow	Capture No.	Distance (m)	Streamflow Change
Chinook	72	107	July 8	Normal	1	-	-
		115	July 10	Flood	2	5.4	Normal to Flood
		125	July 12	Drought	3	6.0	Flood to Drought
		140	July 15	Normal	4	5.4	Drought to Normal
		146	July 17	Flood	5	3.5	Normal to Flood
		168	July 19	Normal	6	2.7	Flood to Normal

Table 9. Kloiya Creek microhabitat study 1985. The mean distance moved, by streamflow change, from the last location for juvenile coho and chinook salmon in Kloiya Creek.

Drought to Drought Streamflow Change

Species	Fish No.	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Coho	9	132	July 12	Drought	5	9.8
Coho	13	134	July 12	Drought	5	2.5
Coho	20	89	July 5	Drought	2	0.4
			N = 3	$\bar{X}$ = 4.23 ± 4.93 m		

Drought to Normal Streamflow Change

Coho	2	139	July 15	Normal	6	12.8
Coho	8	100	July 8	Normal	5	0.4
Coho	8	144	July 15	Normal	8	17.8
Coho	9	162	July 19	Normal	6	14.9
Coho	13	40	June 27	Normal	3	4.6
Coho	15	43	June 27	Normal	2	8.8
Coho	15	105	July 8	Normal	5	1.8
Coho	15	142	July 15	Normal	8	0.6
Coho	16	104	July 8	Normal	4	4.2
Coho	20	136	July 15	Normal	3	1.6
Coho	43	138	July 15	Normal	3	1.2
Coho	64	137	July 15	Normal	2	2.8
			N = 12	$\bar{X}$ = 5.96 ± 6.09 m		
Chinook	5	34	June 27	Normal	3	5.6
Chinook	72	140	July 15	Normal	4	5.4
			N = 2	$\bar{X}$ = 5.50 ± 0.14 m		

Drought to Flood Streamflow Change

Coho	8	67	July 3	Flood	3	9.6
Coho	16	29	June 26	Flood	2	15.4
Coho	16	152	July 17	Flood	6	1.4
Coho	17	22	June 26	Flood	2	3.2
Coho	22	159	July 17	Flood	2	4.6
Coho	36	122	July 10	Flood	4	10.0
Coho	77	158	July 17	Flood	2	5.1
			N = 7	$\bar{X}$ = 7.04 ± 4.86 m		
Chinook	12	66	July 3	Flood	3	7.2
Chinook	14	75	July 3	Flood	3	3.4
Chinook	65	117	July 10	Flood	2	9.0
Chinook	65	148	July 17	Flood	4	17.0
			N = 4	$\bar{X}$ = 9.15 ± 5.73 m		

Table 9 (cont'd)

Species	Fish No.	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Normal to Drought Streamflow Change						
Coho	13	92	July 5	Drought	4	0.8
Coho	16	130	July 12	Drought	5	3.0
Coho	43	124	July 12	Drought	2	1.2
			N = 3	$\bar{X}$ = 1.67 ± 1.17 m		
Chinook	35	90	July 5	Drought	2	3.4
			N = 1	$\bar{X}$ = 3.4 m		
Normal to Normal Streamflow Change						
Coho	38	103	July 8	Normal	2	10.6
Coho	38	143	July 15	Normal	3	2.4
Coho	38	163	July 19	Normal	4	0.5
			N = 3	$\bar{X}$ = 4.50 ± 5.37 m		
Chinook	68	110	July 9	Normal	2	1.4
			N = 1	$\bar{X}$ = 1.4 m		
Normal to Flood Streamflow Change						
Coho	2	78	July 3	Flood	3	4.6
Coho	2	147	July 17	Flood	7	13.9
Coho	8	120	July 10	Flood	6	12.0
Coho	8	156	July 17	Flood	9	10.4
Coho	15	82	July 3	Flood	3	6.0
Coho	15	123	July 10	Flood	6	0.4
Coho	15	154	July 17	Flood	9	2.2
Coho	17	81	July 3	Flood	4	0.8
Coho	17	153	July 17	Flood	7	1.4
Coho	34	65	July 3	Flood	2	4.2
Coho	36	80	July 3	Flood	2	9.4
Coho	40	79	July 3	Flood	2	10.0
Coho	41	111	July 10	Flood	2	0.2
Coho	42	149	July 17	Flood	2	6.8
Coho	43	150	July 17	Flood	4	5.5
Coho	69	119	July 10	Flood	2	5.7
Coho	69	157	July 17	Flood	4	13.8
			N = 17	$\bar{X}$ = 6.31 ± 4.60 m		
Chinook	3	68	July 3	Flood	3	1.8
Chinook	72	115	July 10	Flood	2	5.4
Chinook	72	146	July 17	Flood	5	3.5
			N = 3	$\bar{X}$ = 3.57 ± 1.80 m		

Table 9 (cont'd)

Species	Fish No.	Recapture Location	Date	Stream flow	Recapture No.	Distance (m)
Flood to Drought Streamflow Change						
Coho	2	127	July 12	Drought	5	8.6
Coho	4	133	July 12	Drought	3	5.0
Coho	8	18	June 25	Drought	2	3.8
Coho	8	91	July 5	Drought	4	8.5
Coho	8	131	July 12	Drought	7	12.0
Coho	9	93	July 5	Drought	4	20.0
Coho	10	84	July 5	Drought	3	2.0
Coho	13	20	June 25	Drought	2	13.9
Coho	15	94	July 5	Drought	4	2.3
Coho	15	129	July 12	Drought	7	0.2
Coho	16	95	July 5	Drought	3	14.6
Coho	36	96	July 5	Drought	3	12.0
Coho	62	128	July 12	Drought	2	0.2
			N = 13	$\bar{X}$ = 7.93 ± 6.27 m		
Chinook	5	19	June 25	Drought	2	5.0
Chinook	12	16	June 25	Drought	2	6.6
Chinook	14	17	June 25	Drought	2	7.2
Chinook	52	86	July 5	Drought	2	3.0
Chinook	65	126	July 12	Drought	3	13.2
Chinook	72	125	July 12	Drought	3	6.0
			N = 6	$\bar{X}$ = 6.83 ± 3.45 m		
Flood to Normal Streamflow Change						
Coho	2	170	July 19	Normal	8	12.5
Coho	8	160	July 19	Normal	10	10.0
Coho	15	165	July 19	Normal	10	3.8
Coho	16	166	July 19	Normal	7	2.0
Coho	17	41	June 27	Normal	3	4.0
Coho	17	141	July 15	Normal	6	7.4
Coho	17	164	July 19	Normal	8	6.4
Coho	36	167	July 19	Normal	6	1.0
Coho	42	172	July 19	Normal	3	8.9
Coho	55	171	July 19	Normal	3	17.0
Coho	69	145	July 15	Normal	3	5.2
Coho	77	161	July 19	Normal	3	13.4
			N = 12	$\bar{X}$ = 7.63 ± 4.89 m		
Chinook	65	169	July 19	Normal	5	14.8
Chinook	72	168	July 19	Normal	6	2.7
			N = 2	$\bar{X}$ = 8.75 ± 8.56 m		
Flood to Flood Streamflow Change						
Coho	2	116	July 10	Flood	4	50.0
Coho	9	7	June 23	Flood	2	1.4
Coho	9	77	July 3	Flood	3	3.0
Coho	17	121	July 10	Flood	5	3.6
Coho	36	155	July 17	Flood	5	10.6
Coho	41	151	July 17	Flood	3	5.4
Coho	55	113	July 10	Flood	2	1.0
			N = 7	$\bar{X}$ = 10.71 ± 17.62 m		
Chinook	46	118	July 10	Flood	2	50.0
			N = 1	$\bar{X}$ = 50.0 m		

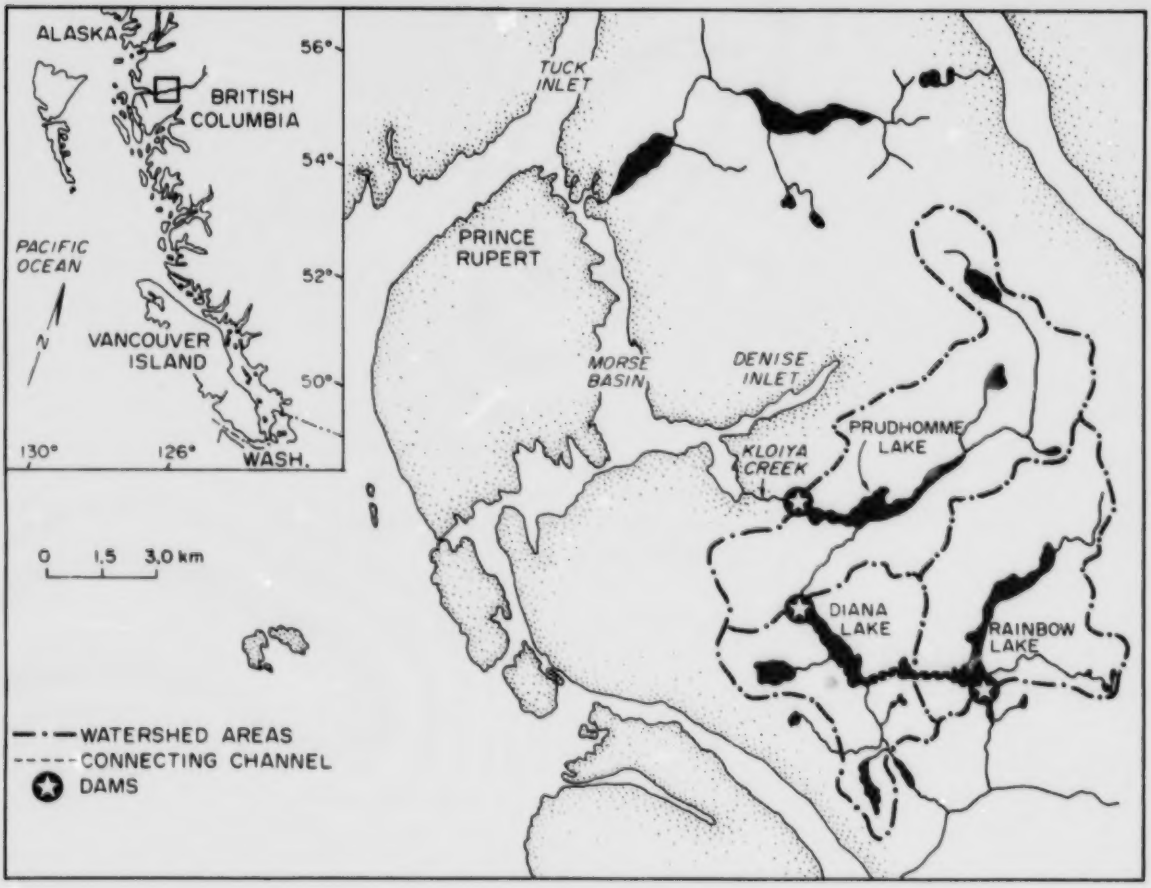

Fig. 1. Map of Kloiya Creek and the surrounding area showing the location of the study area.

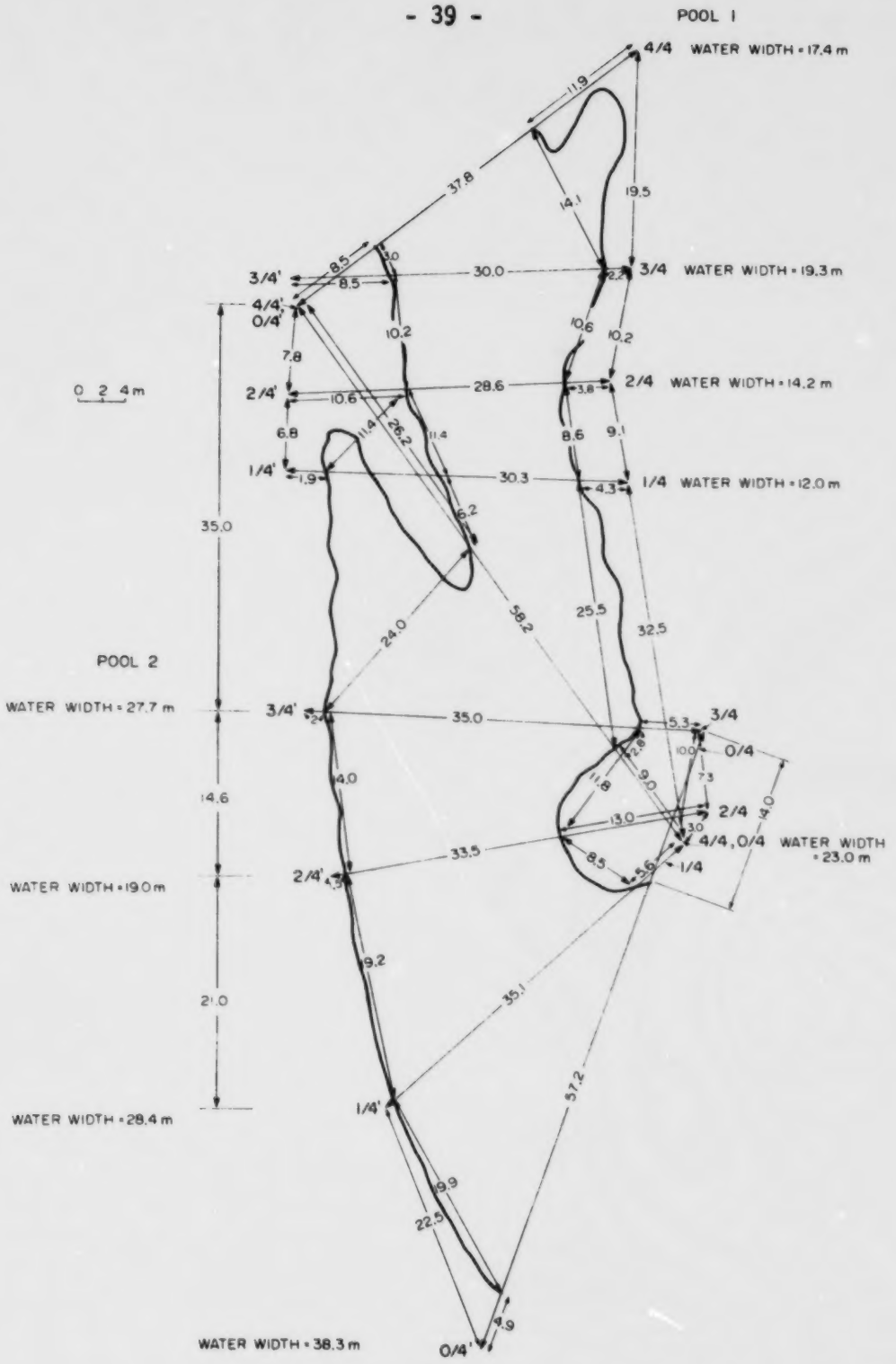
POOL 1
4/4 WATER WIDTH = 17.4 m
3/4 WATER WIDTH = 19.3 m
2/4 WATER WIDTH = 14.2 m
1/4 WATER WIDTH = 12.0 m
0 2 4 m
POOL 2
WATER WIDTH = 27.7 m
WATER WIDTH = 19.0 m
WATER WIDTH = 28.4 m
WATER WIDTH = 38.3 m
4/4,0/4 WATER WIDTH = 23.0 m
35.0
14.6
21.0

Fig. 2. Kloiya Creek. Map showing the length (m) and location of each transect, pools 1 and 2.

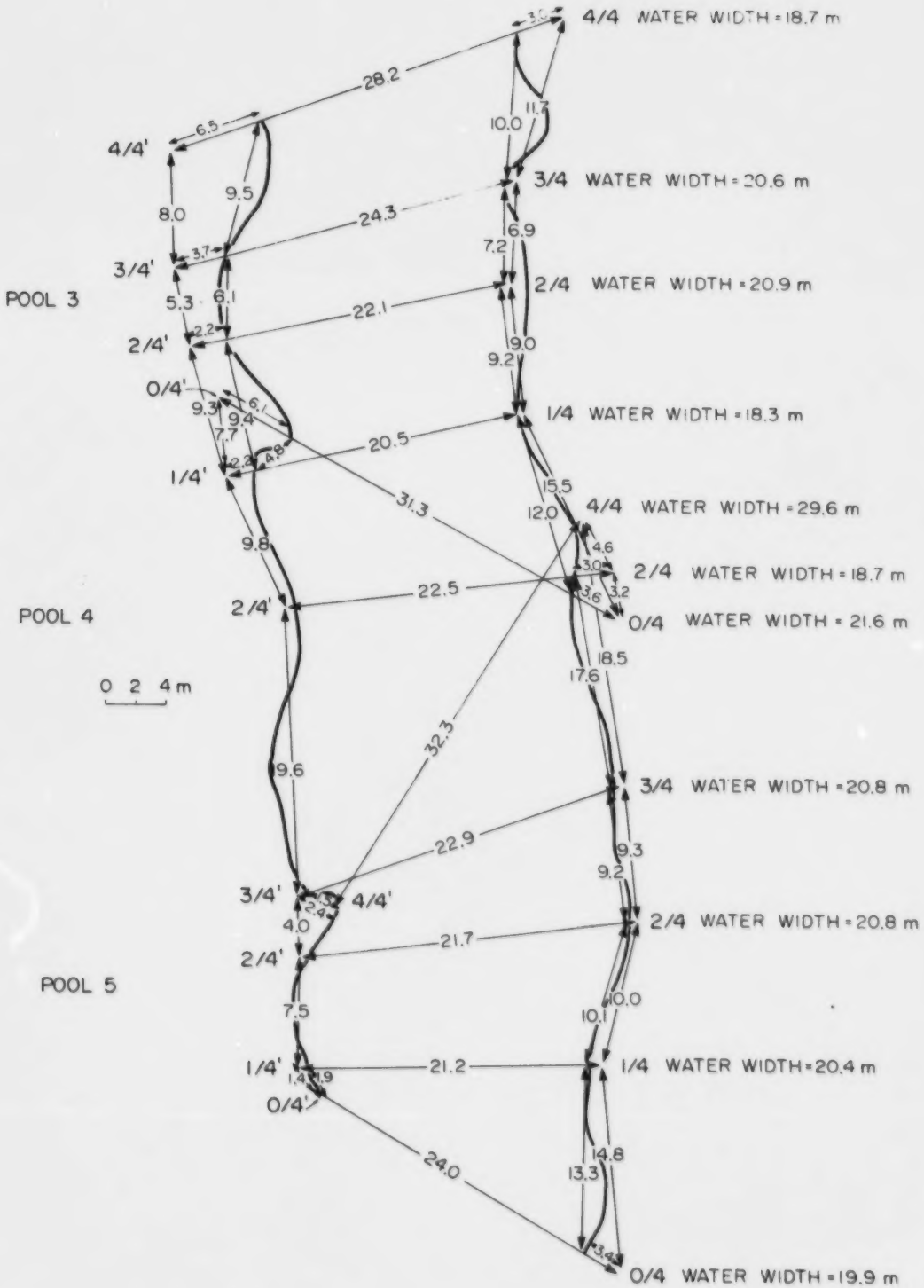

Fig. 3. Kloiya Creek. Map showing the length (m) and location of each transect, pools 3, 4 and 5.

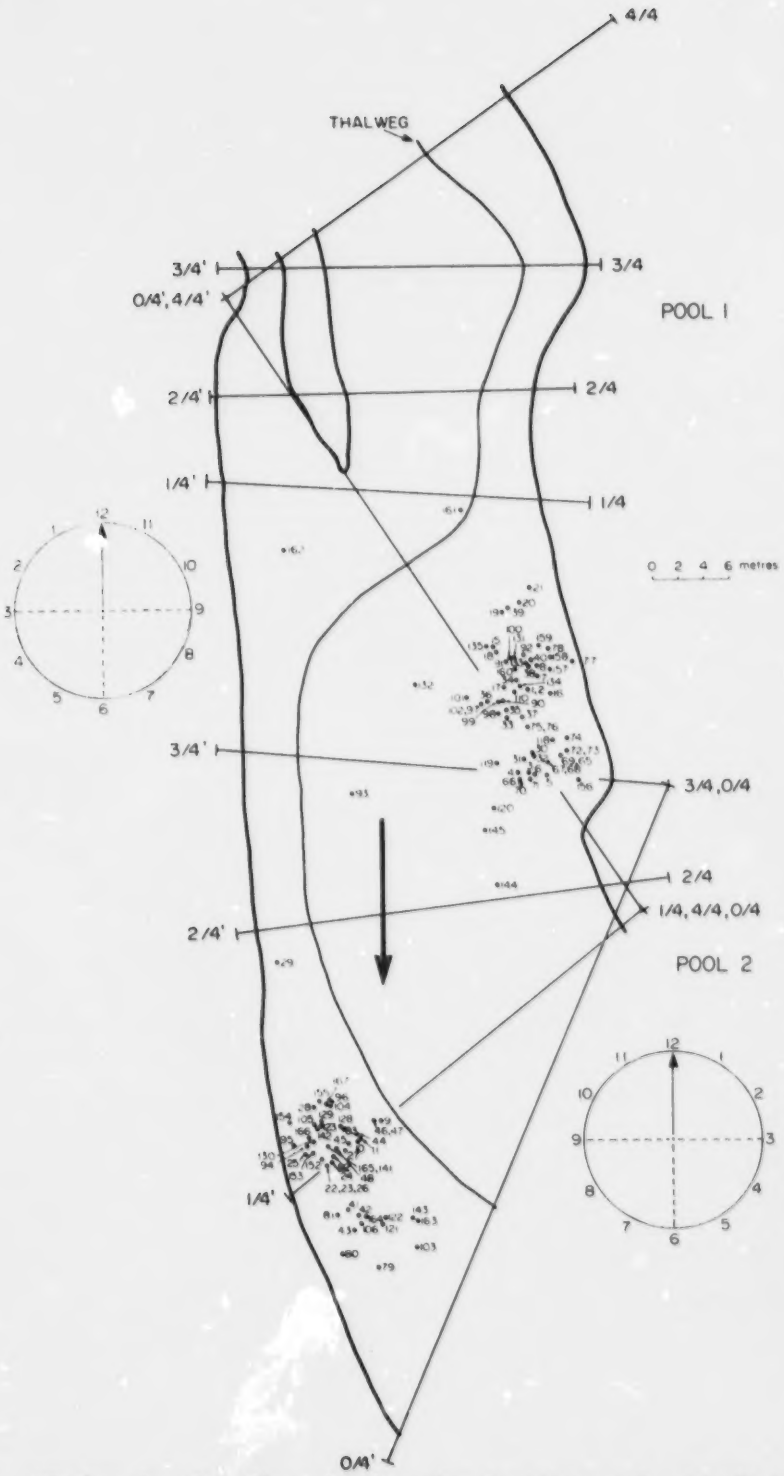

Fig. 4. Kloiya Creek. Map showing the tagging and recapture locations of all juvenile coho and chinook salmon, pools 1 and 2.

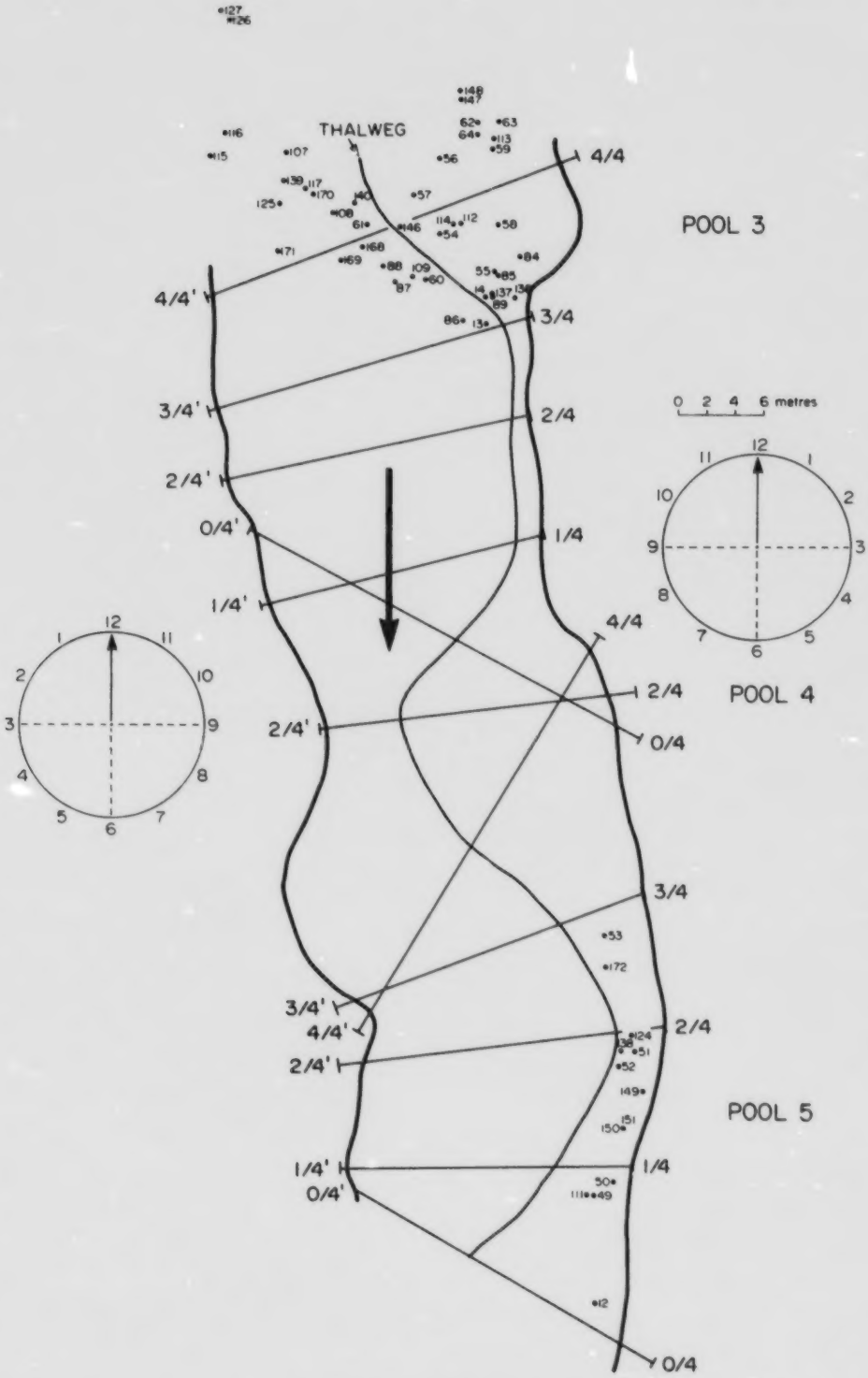

Fig. 5. Kloiya Creek. Map showing the tagging and recapture locations of all juvenile coho and chinook salmon, pools 3, 4 and 5.

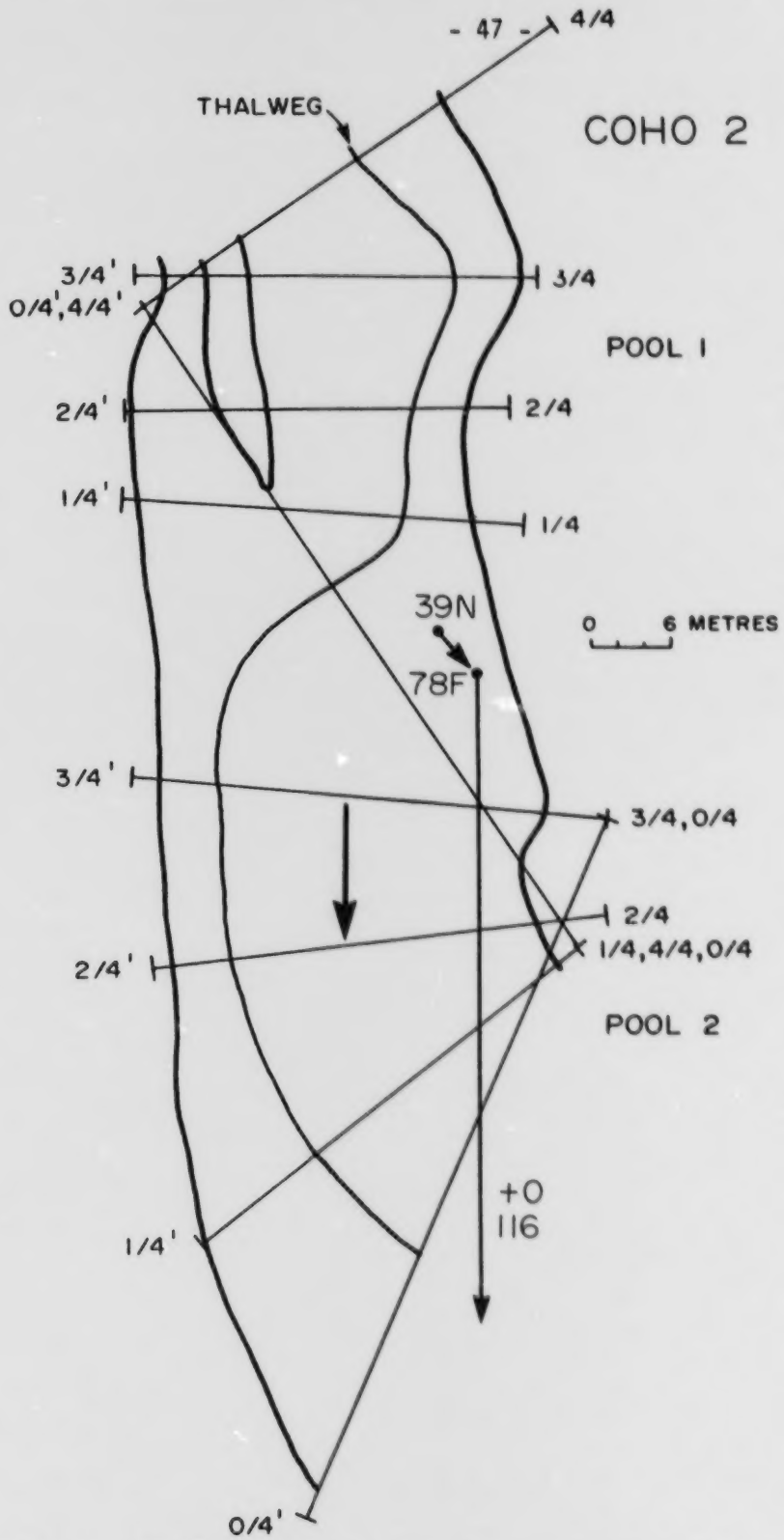

Fig. 6. Kloiya Creek. Map showing the recapture locations for coho 2 (tagging location not recorded).

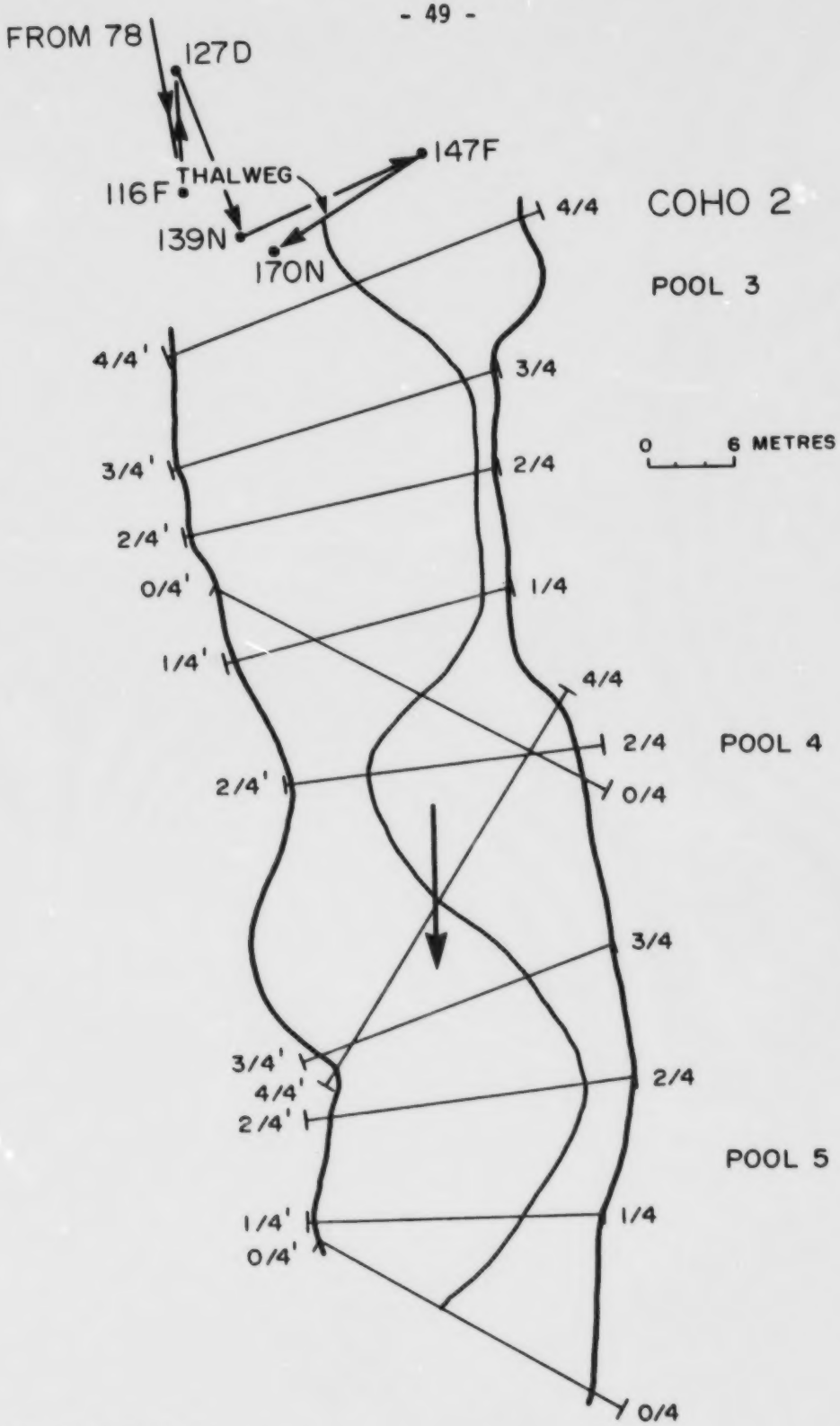
FROM 78
127D
147F
THALWEG
116F
139N
170N
4/4
COHO 2
POOL 3
4/4'
3/4
3/4'
2/4
0 6 METRES
2/4'
0/4'
1/4
1/4'
4/4
2/4
POOL 4
2/4'
0/4
3/4
3/4'
4/4'
2/4
2/4'
POOL 5
1/4'
1/4
0/4'
0/4

Fig. 6 (cont'd).

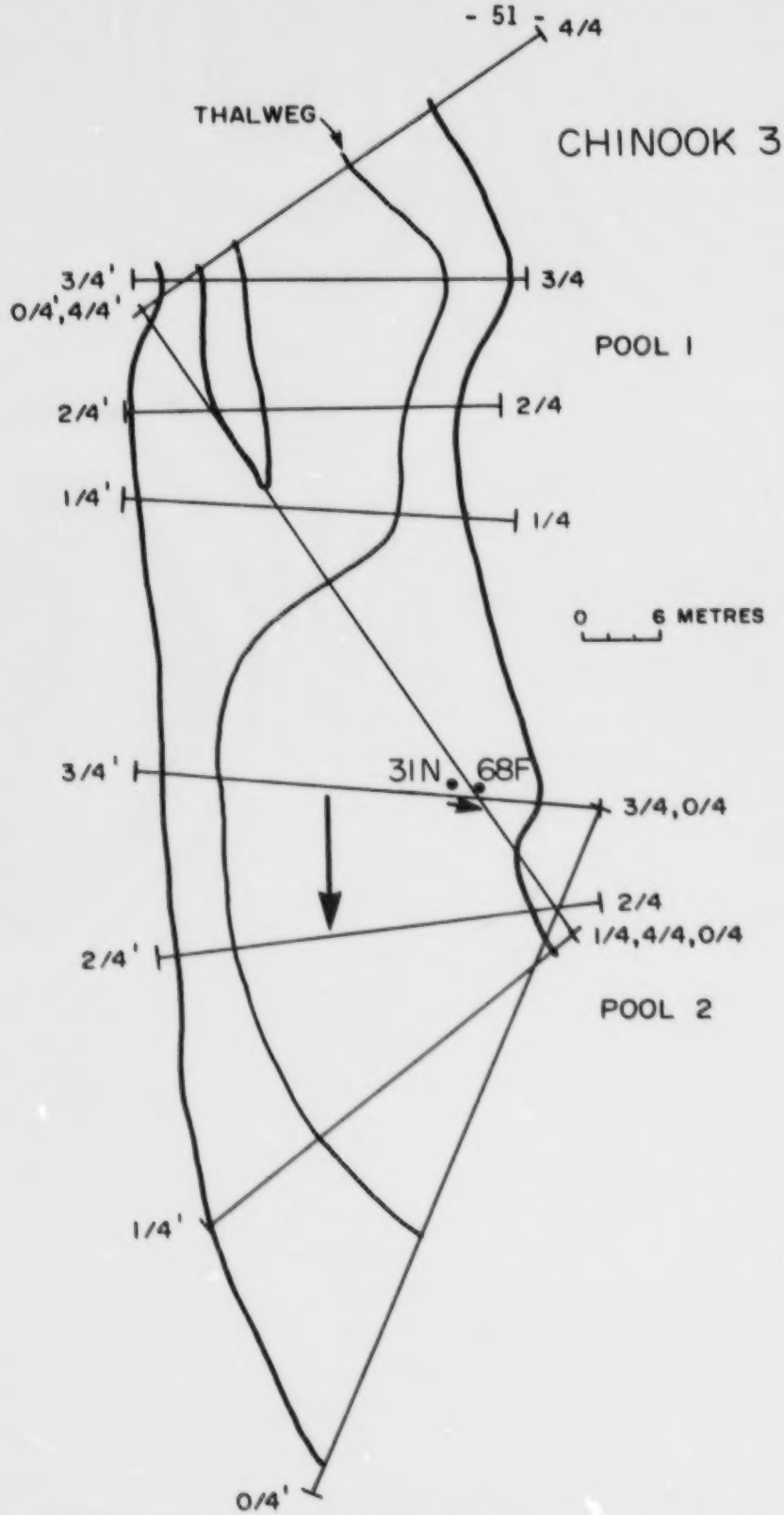

Fig. 7. Kloiya Creek. Map showing the recapture locations for chinook 3 (tagging location not recorded).

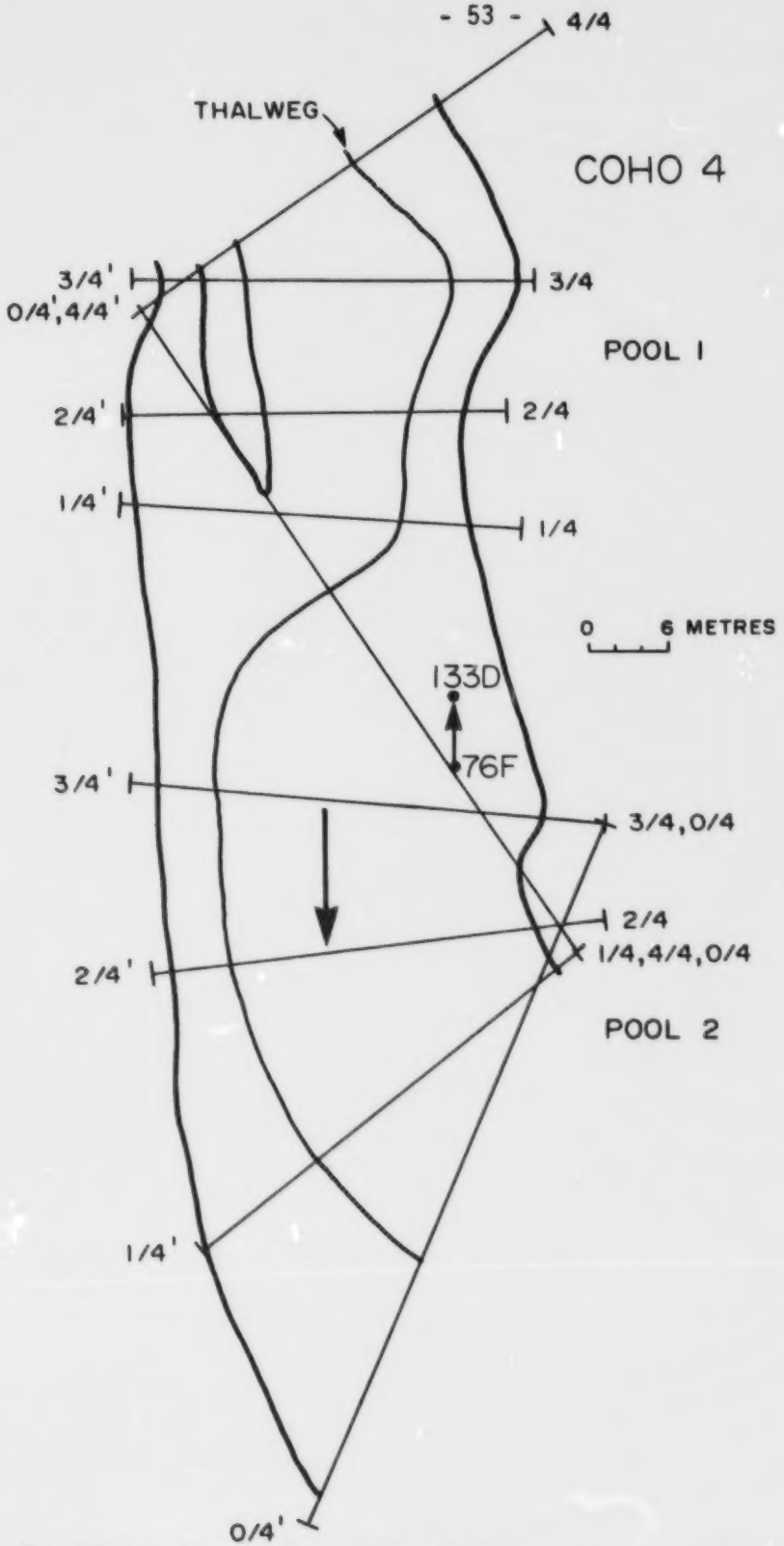

Fig. 8. Kloiya Creek. Map showing the recapture locations for coho 4 (tagging location not recorded).

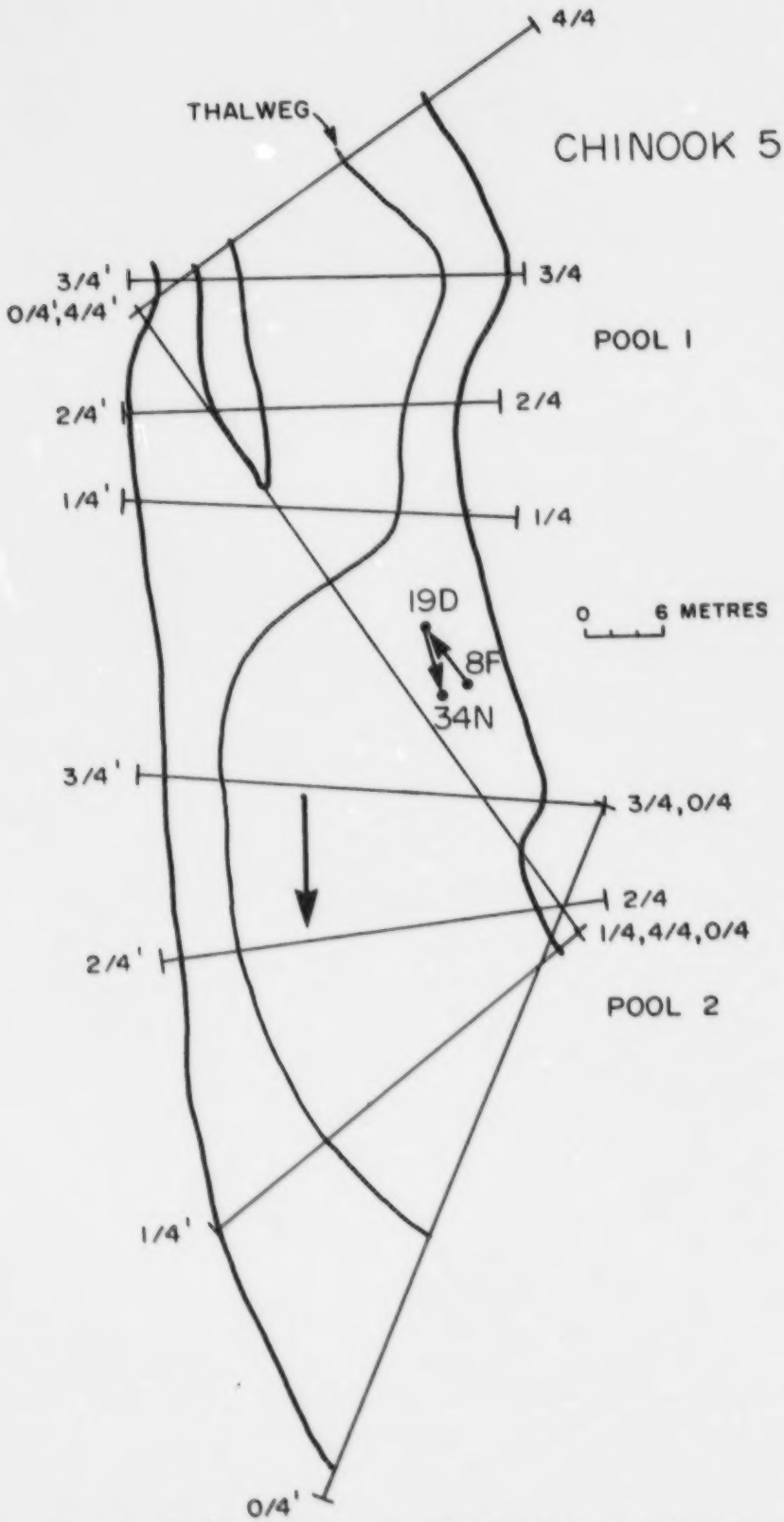

Fig. 9. Kloiya Creek. Map showing the recapture locations for chinook 5 (tagging location not recorded).

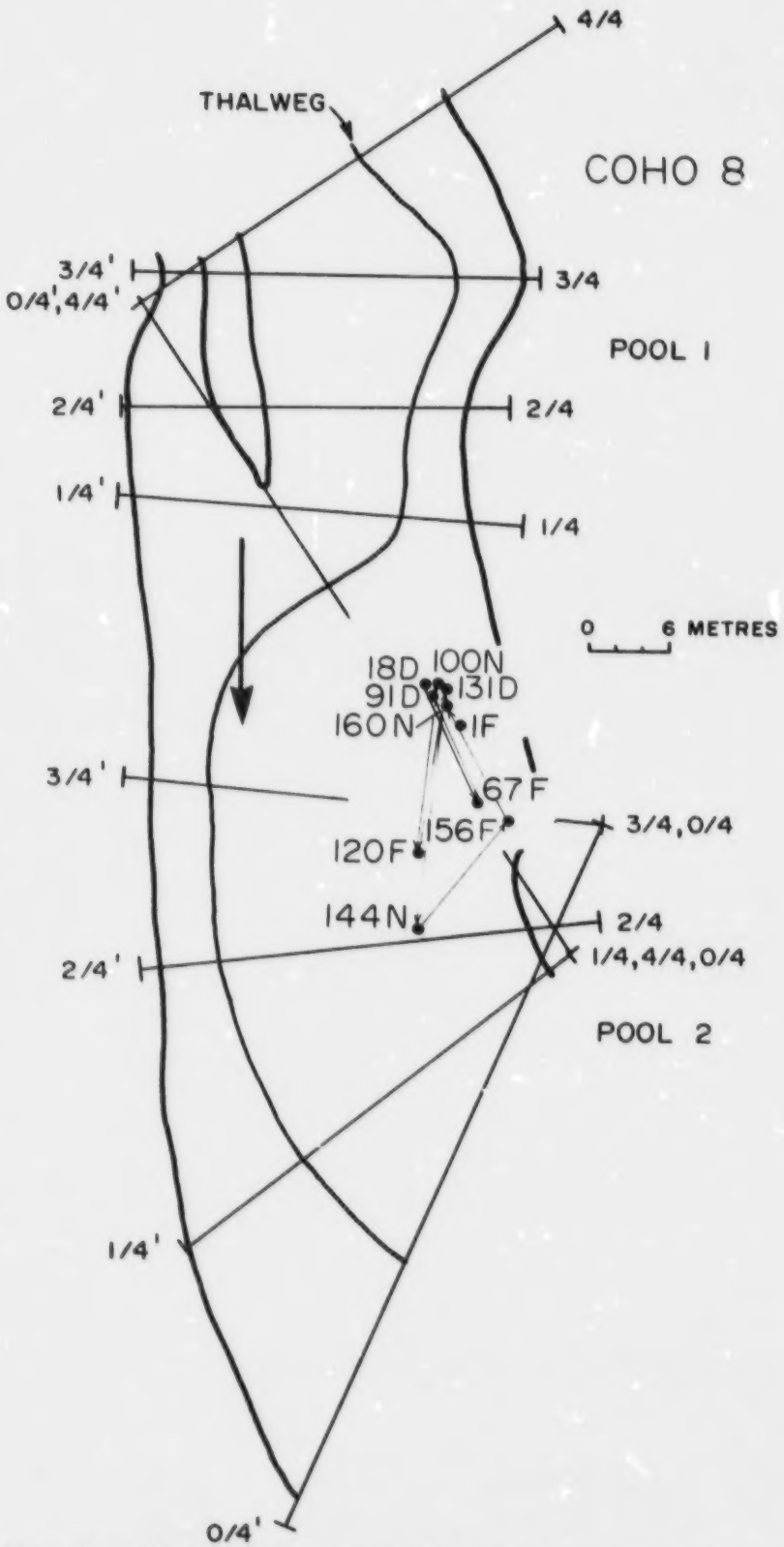

Fig. 10. Kloiya Creek. Map showing the tagging and recapture locations for coho 8.

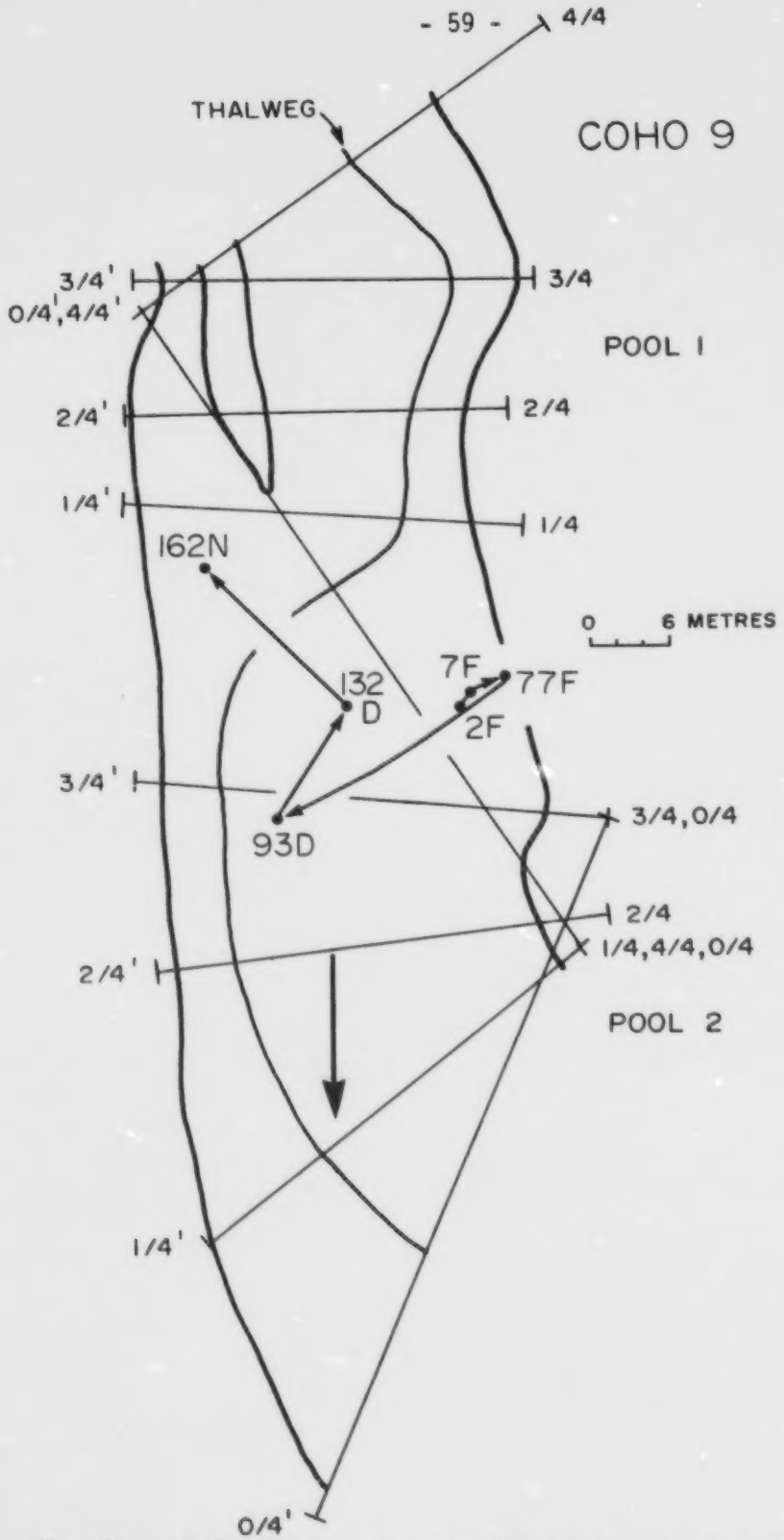

Fig. 11. Kloiya Creek. Map showing the tagging and recapture locations for coho 9.

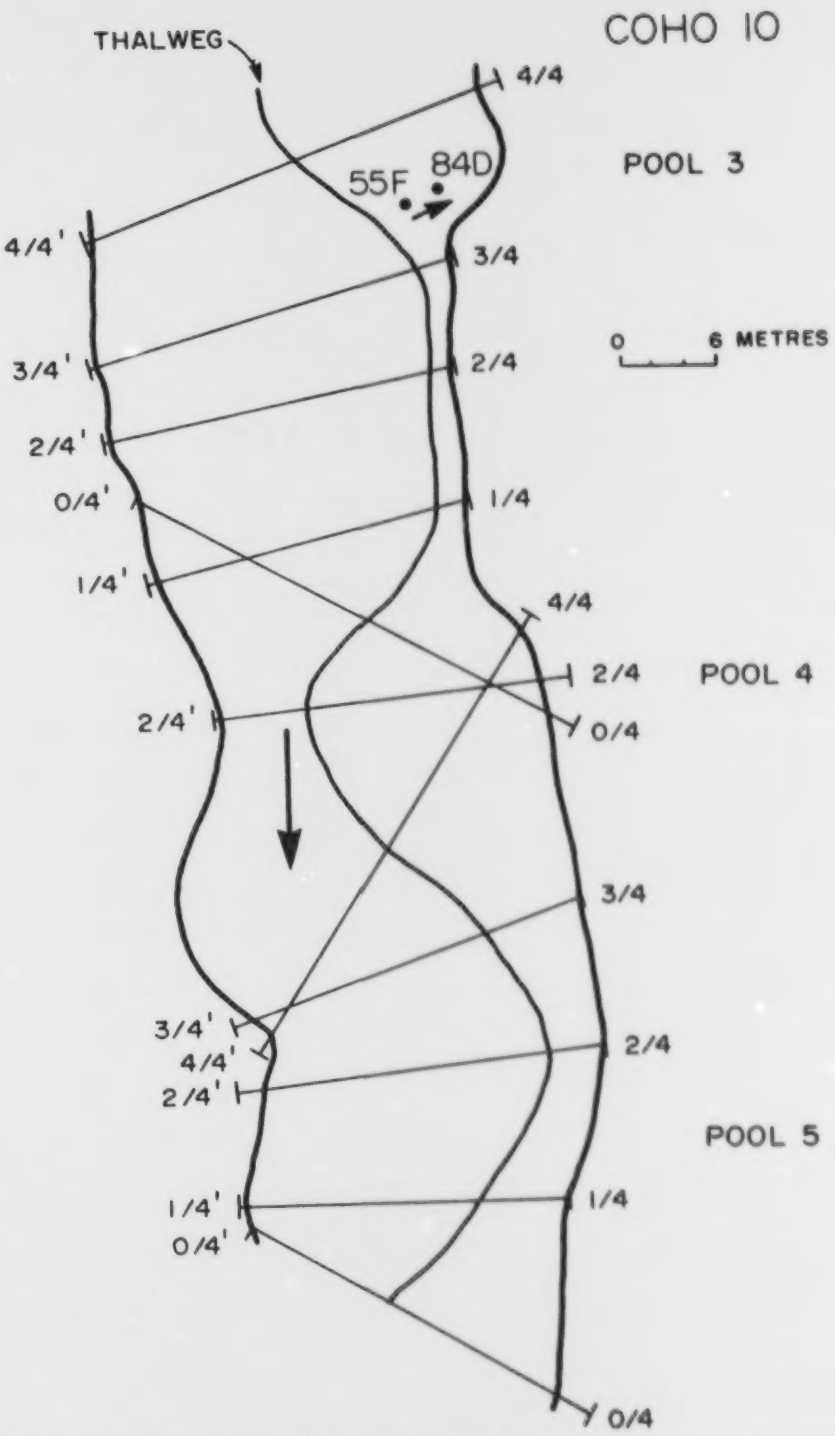

Fig. 12. Kloiya Creek. Map showing the recapture locations for coho 10 (tagging location not recorded).

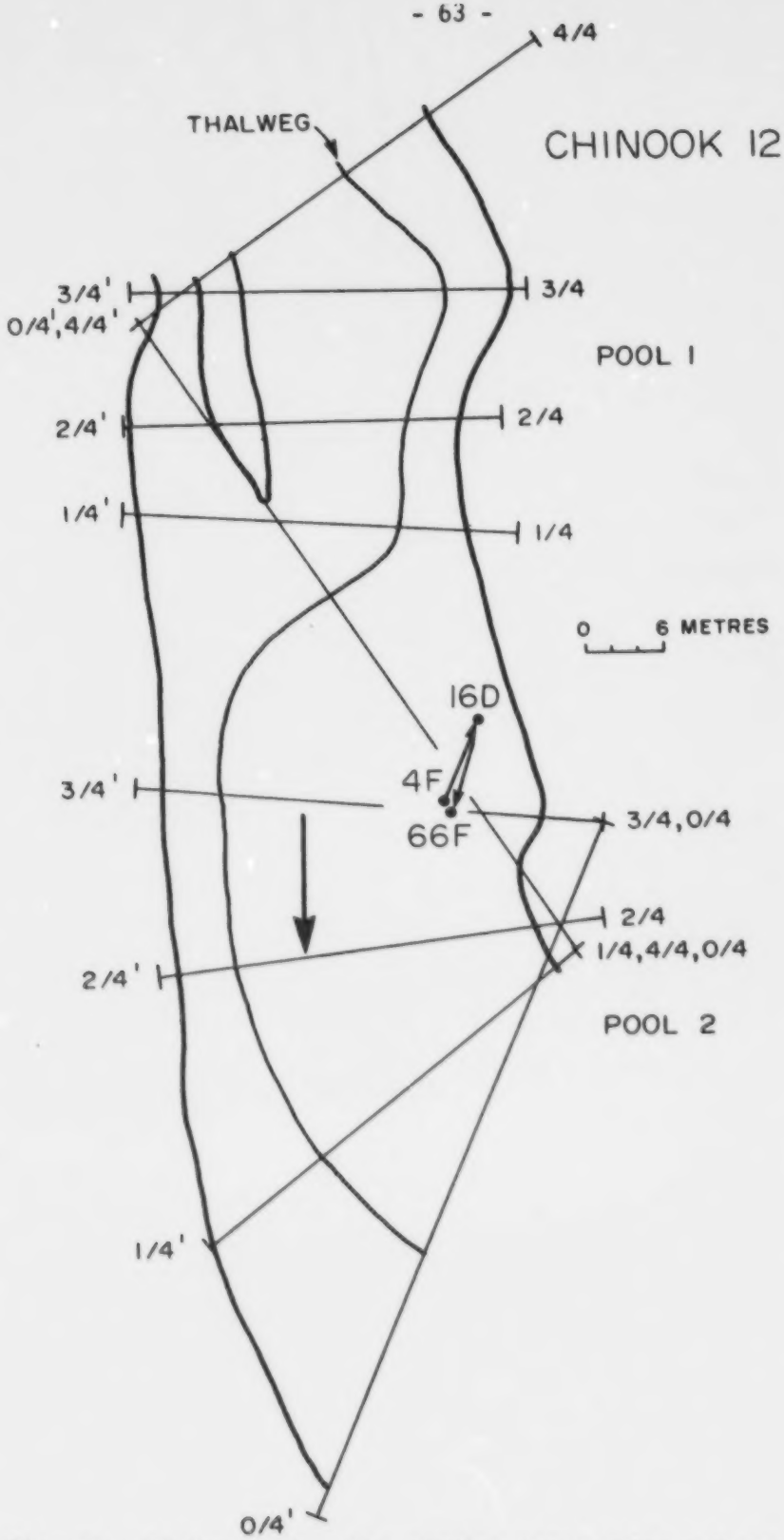

Fig. 13. Kloiya Creek. Map showing the tagging and recapture locations for chinook 12.

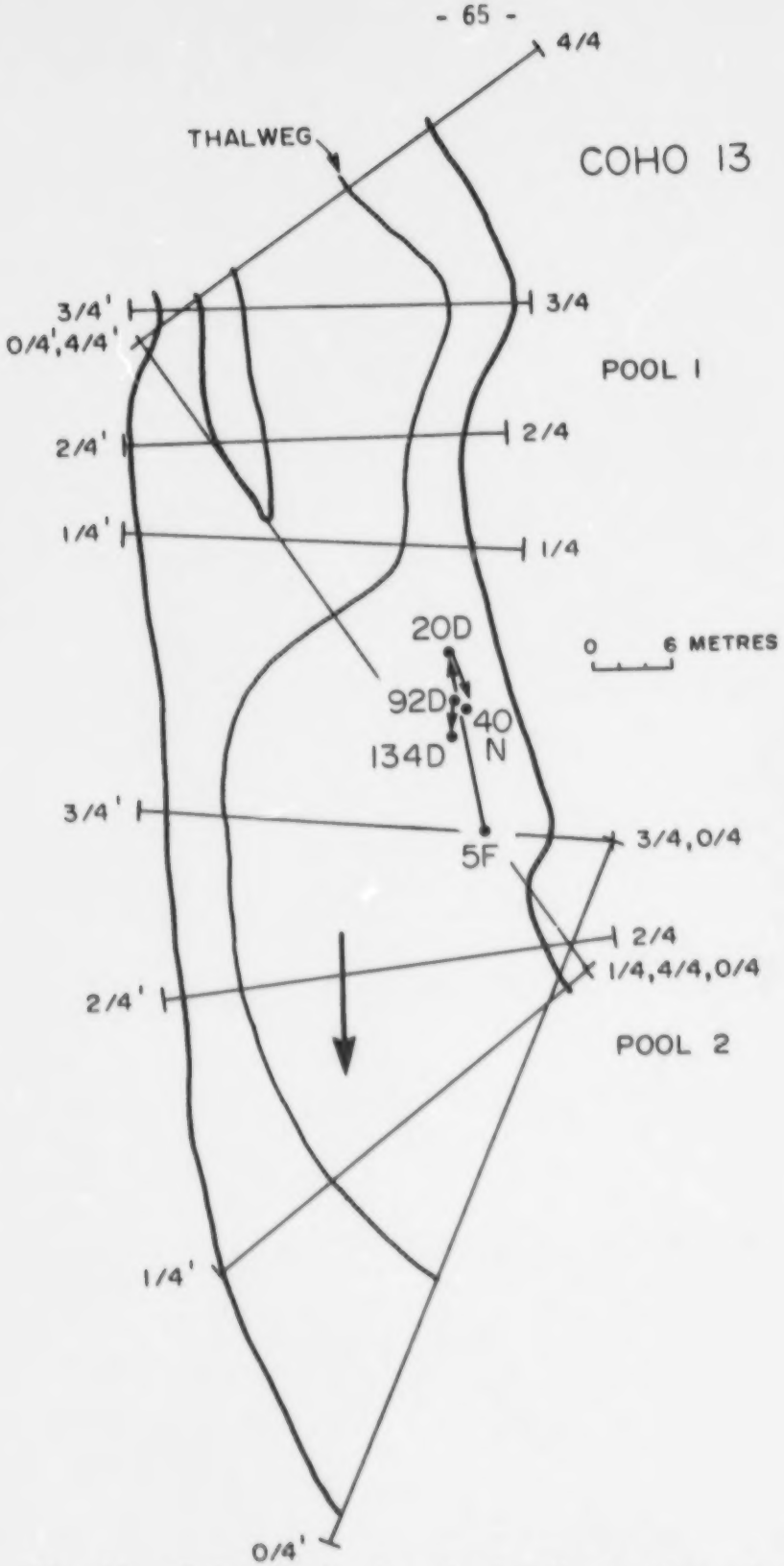

Fig. 14. Kloiya Creek. Map showing the tagging and recapture locations for coho 13.

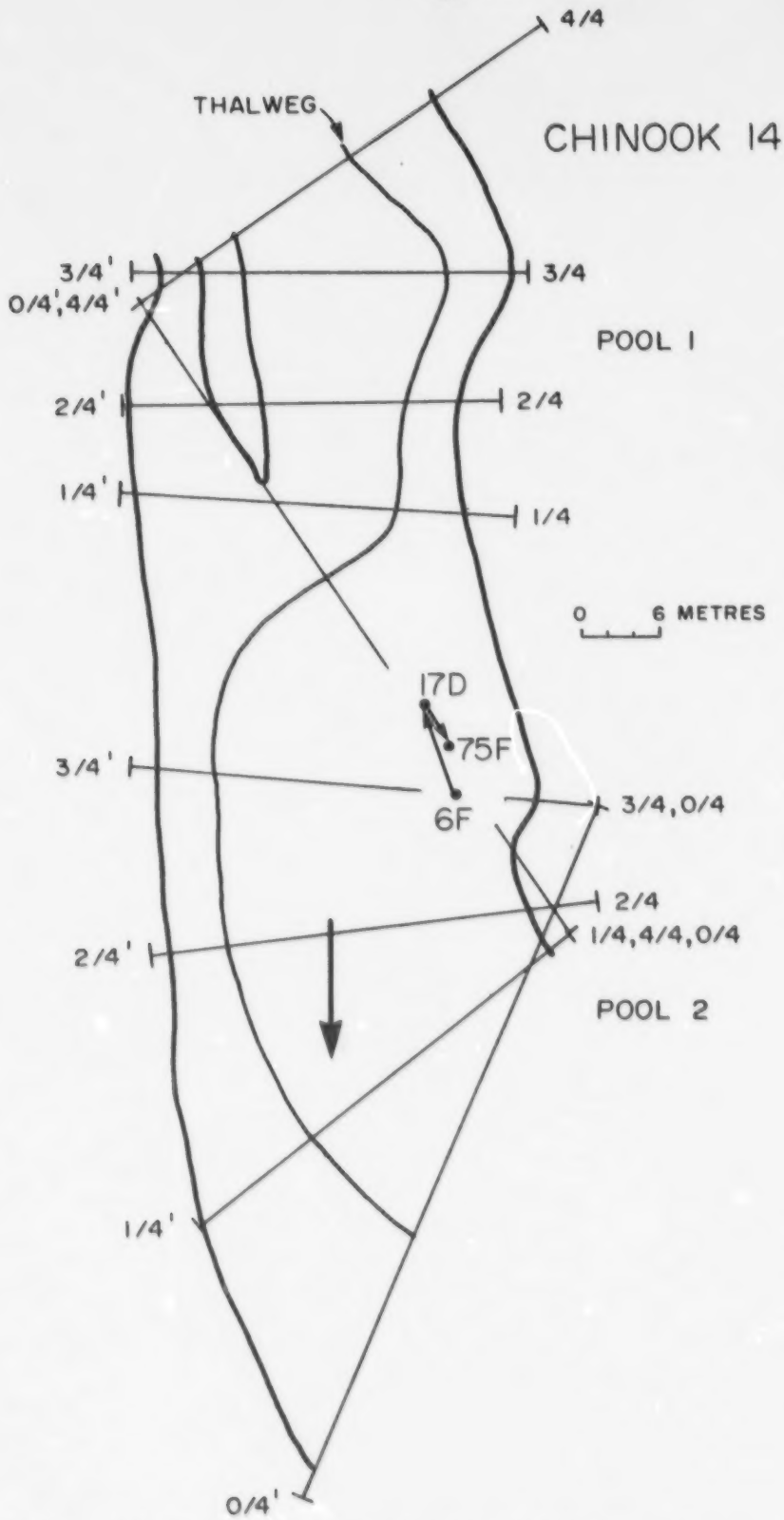

Fig. 15. Kloiya Creek. Map showing the tagging and recapture locations for chinook 14.

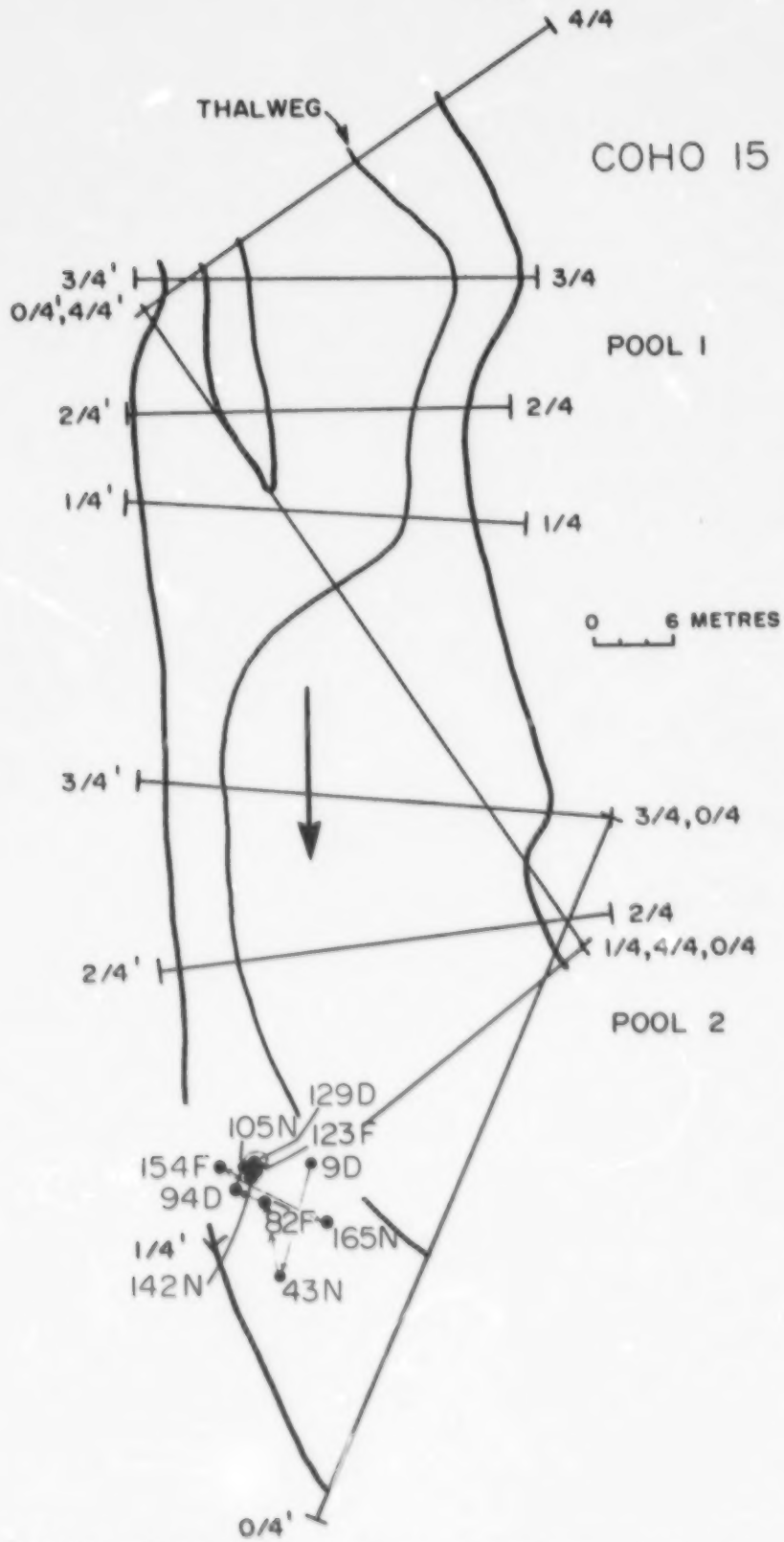

Fig. 16. Kloiya Creek. Map showing the tagging and recapture locations for coho 15.

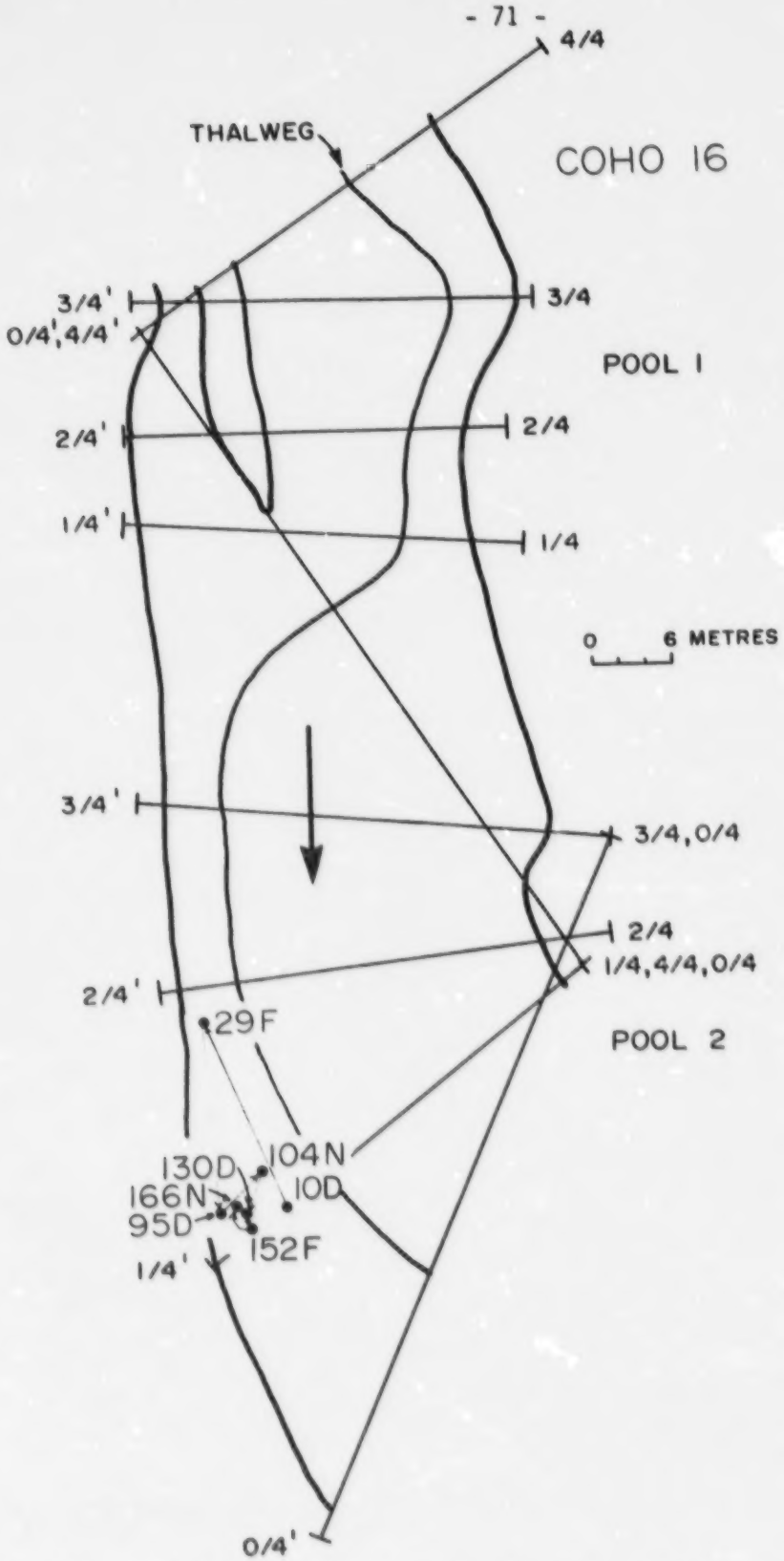

Fig. 17. Kloiya Creek. Map showing the tagging and recapture locations for coho 16.

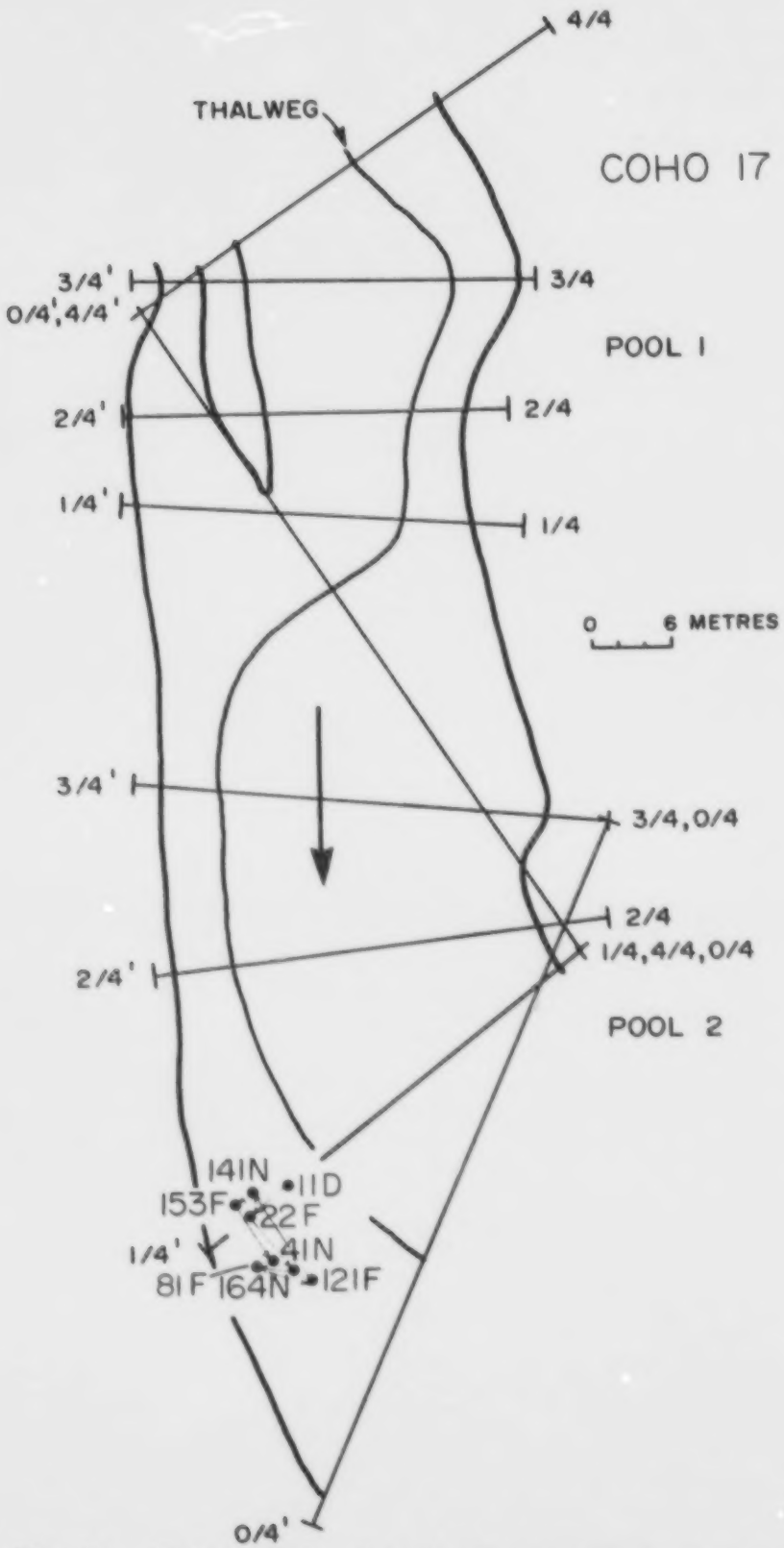

Fig. 18. Kloiya Creek. Map showing the tagging and recapture locations for coho 17.

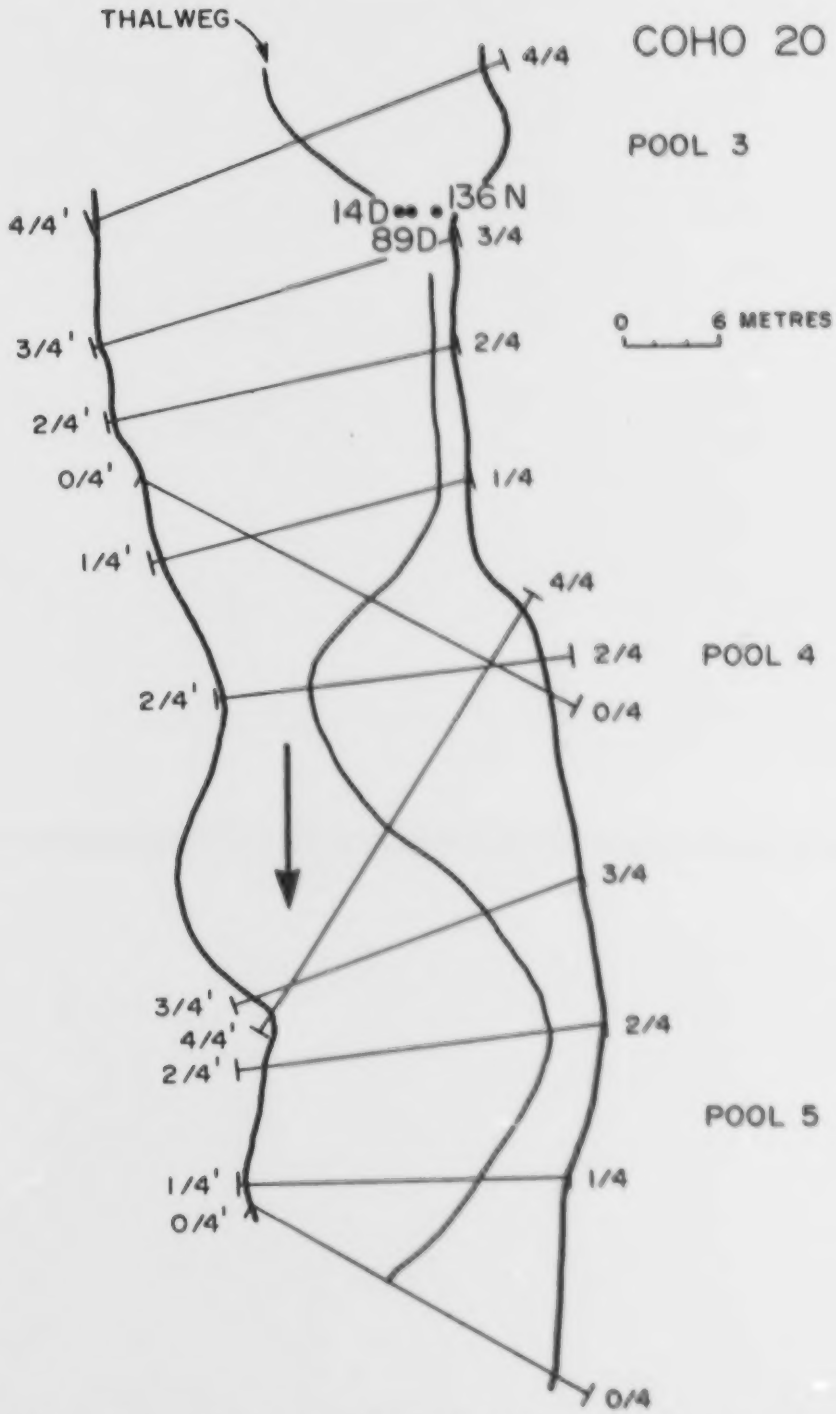

Fig. 19. Kloiya Creek. Map showing the tagging and recapture locations for coho 20.

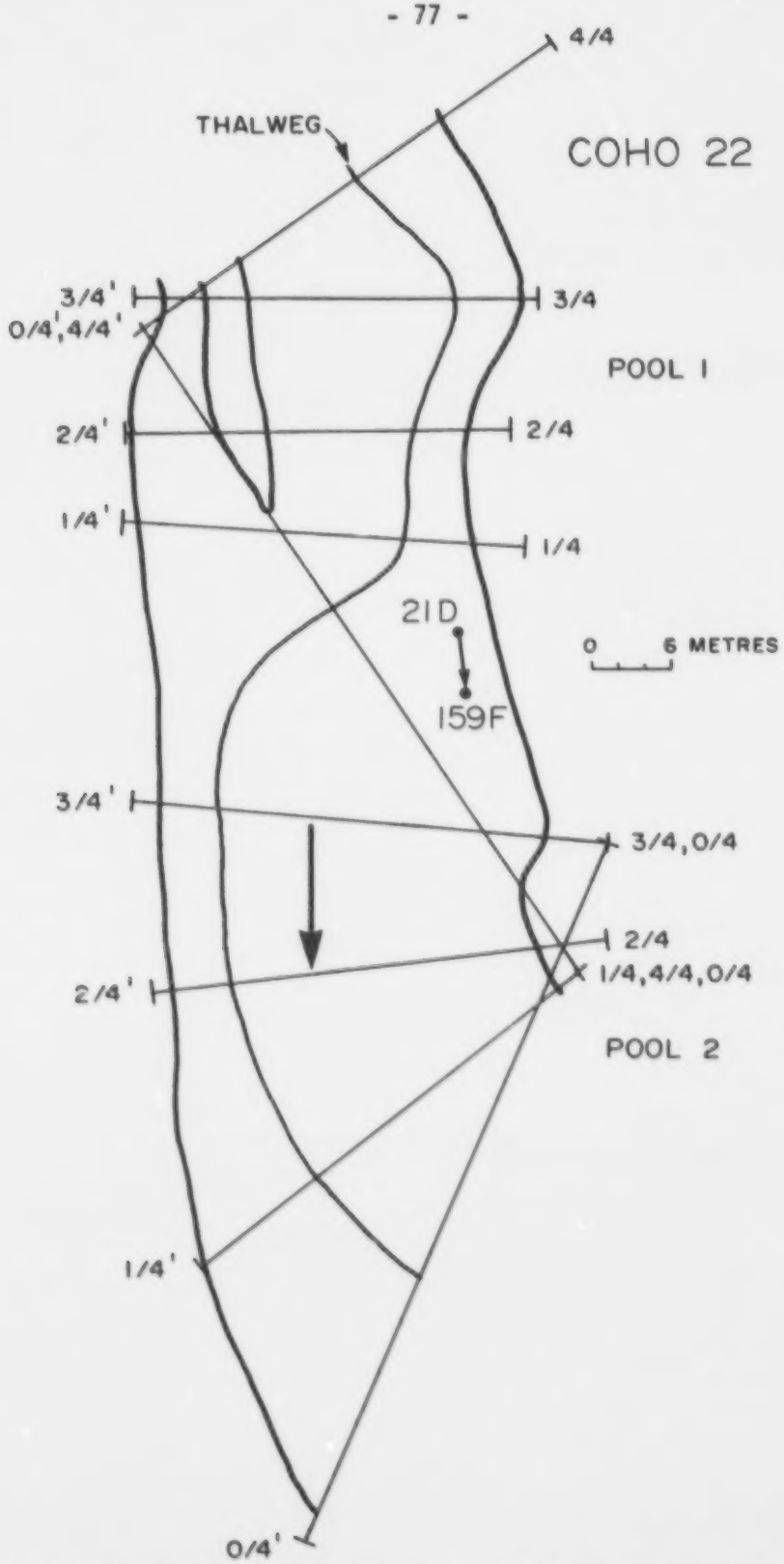

Fig. 20. Kloiya Creek. Map showing the tagging and recapture locations for coho 22.

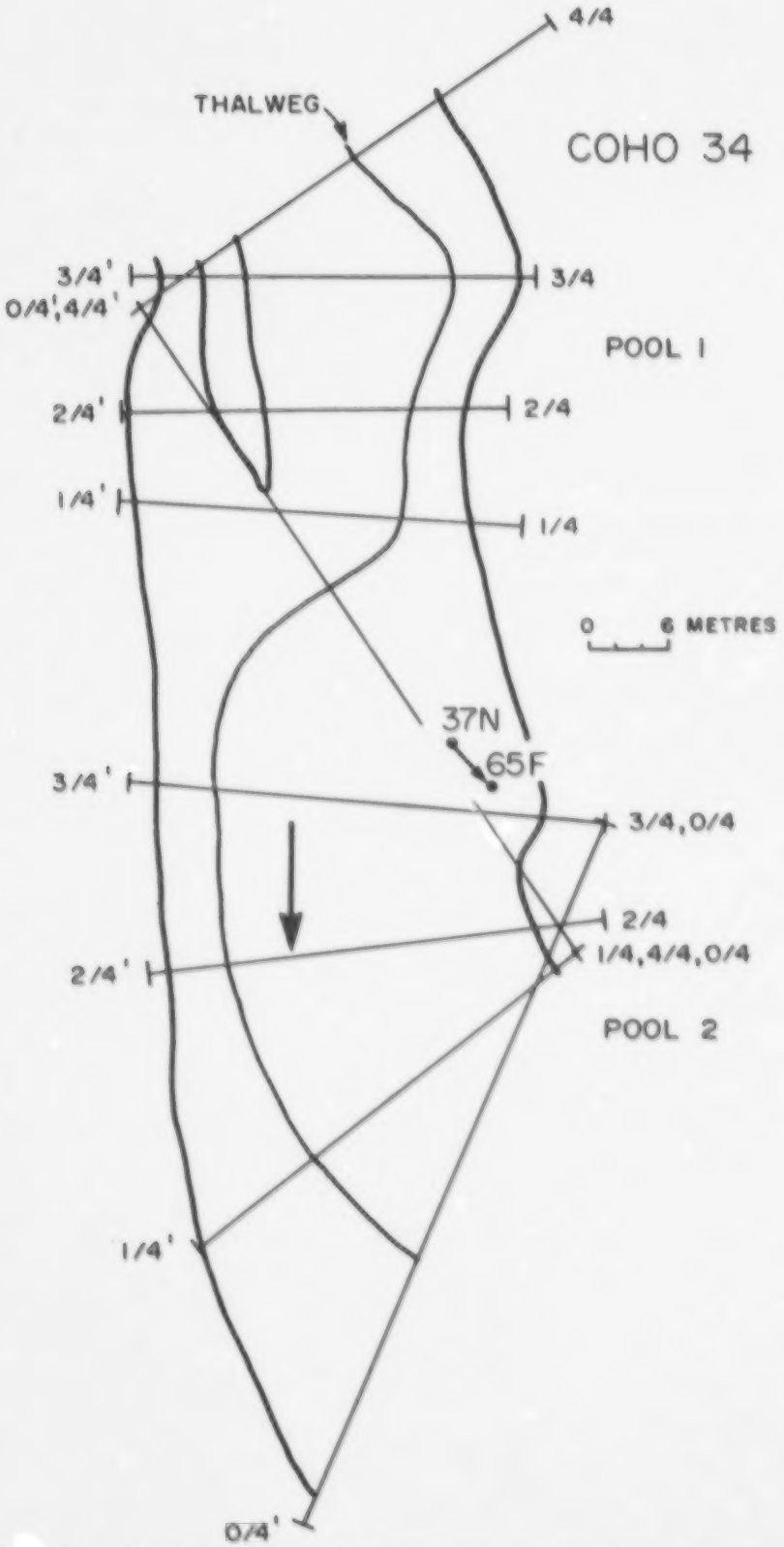

Fig. 21. Kloiya Creek. Map showing the tagging and recapture locations for coho 34.

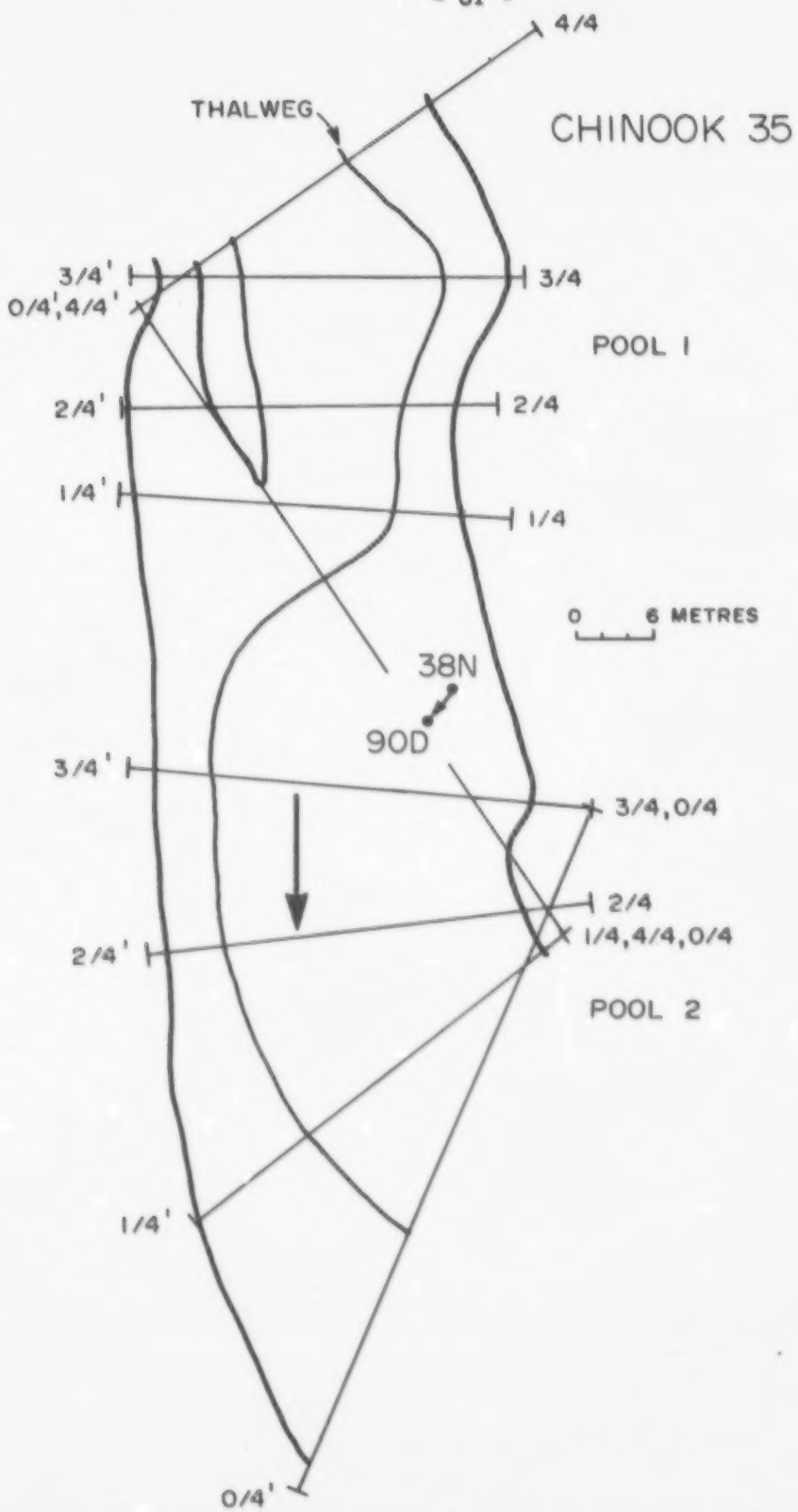

Fig. 22. Kloiya Creek. Map showing the tagging and recapture locations for chinook 35.

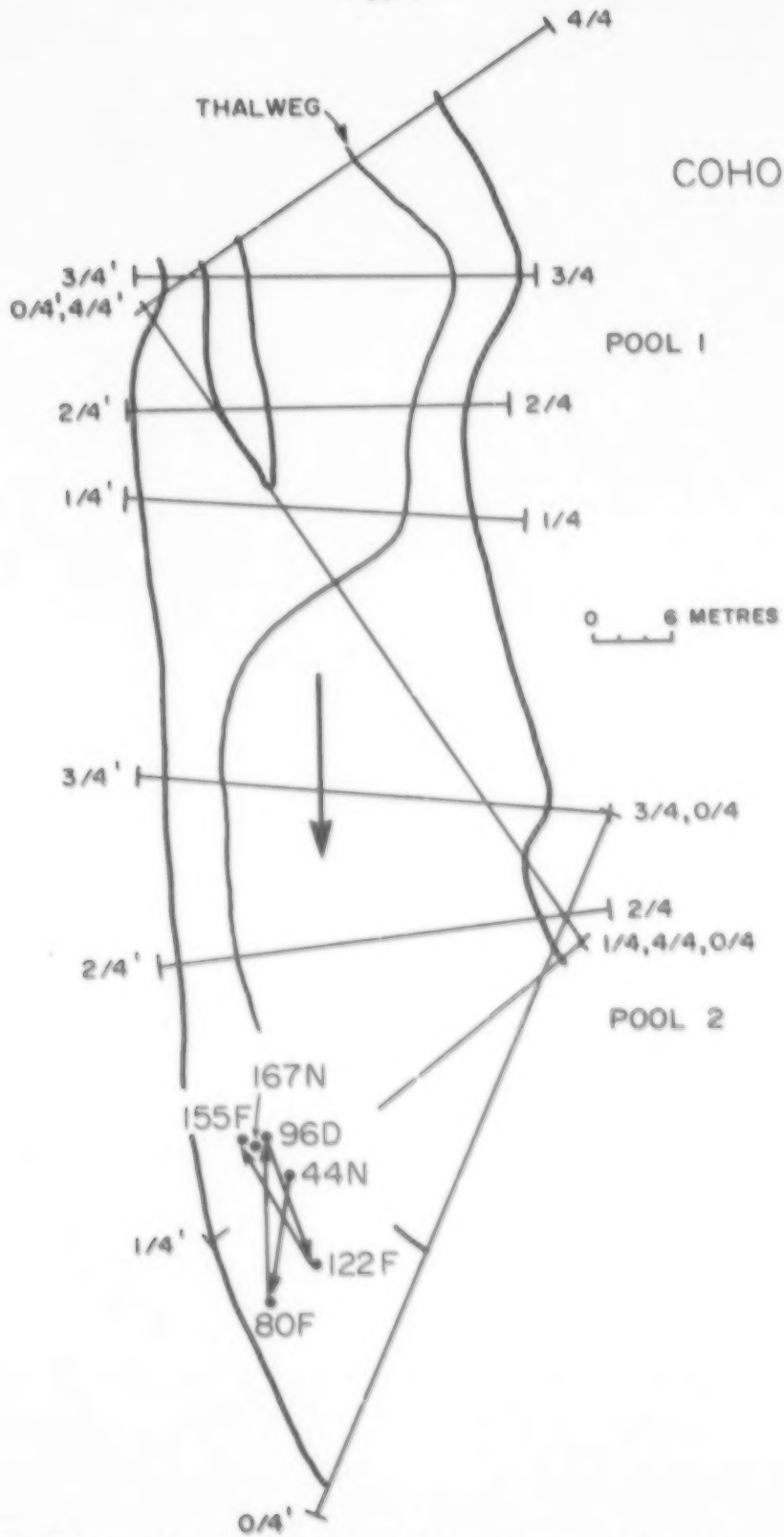

Fig. 23. Kloiya Creek. Map showing the tagging and recapture locations for coho 36.

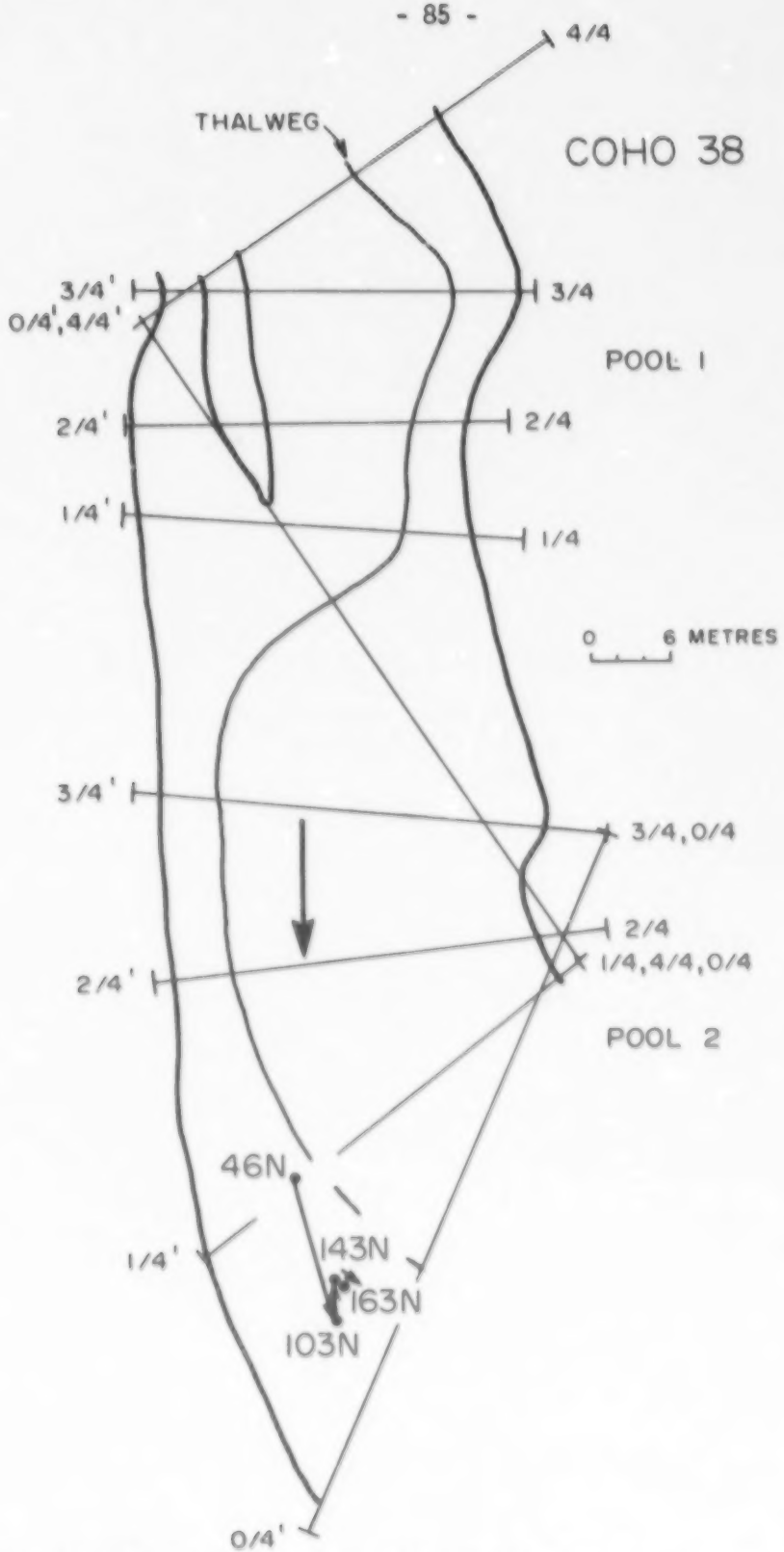

Fig. 24. Kloiya Creek. Map showing the tagging and recapture locations for coho 38.

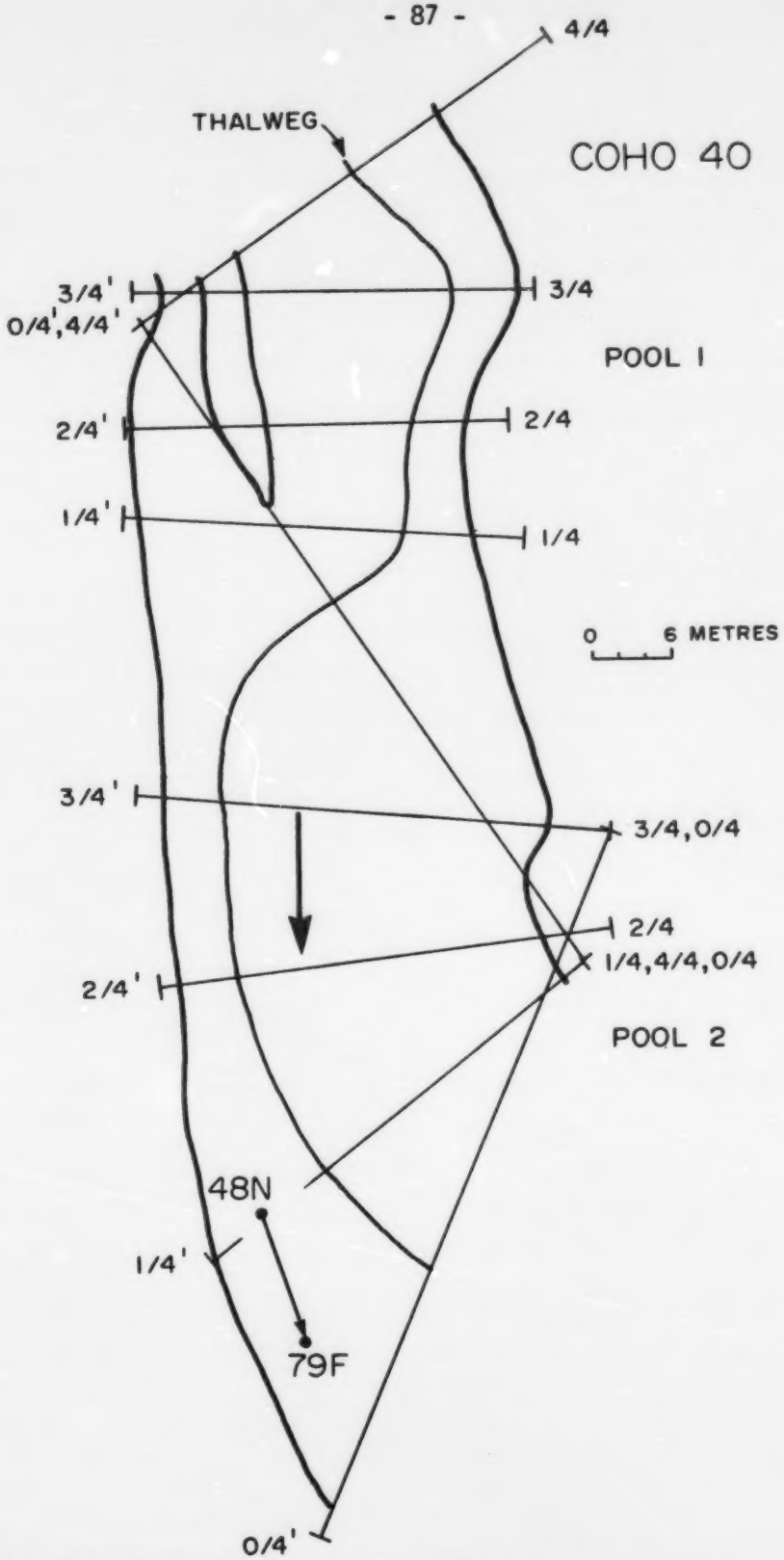

Fig. 25. Kloiya Creek. Map showing the tagging and recapture locations for coho 40.

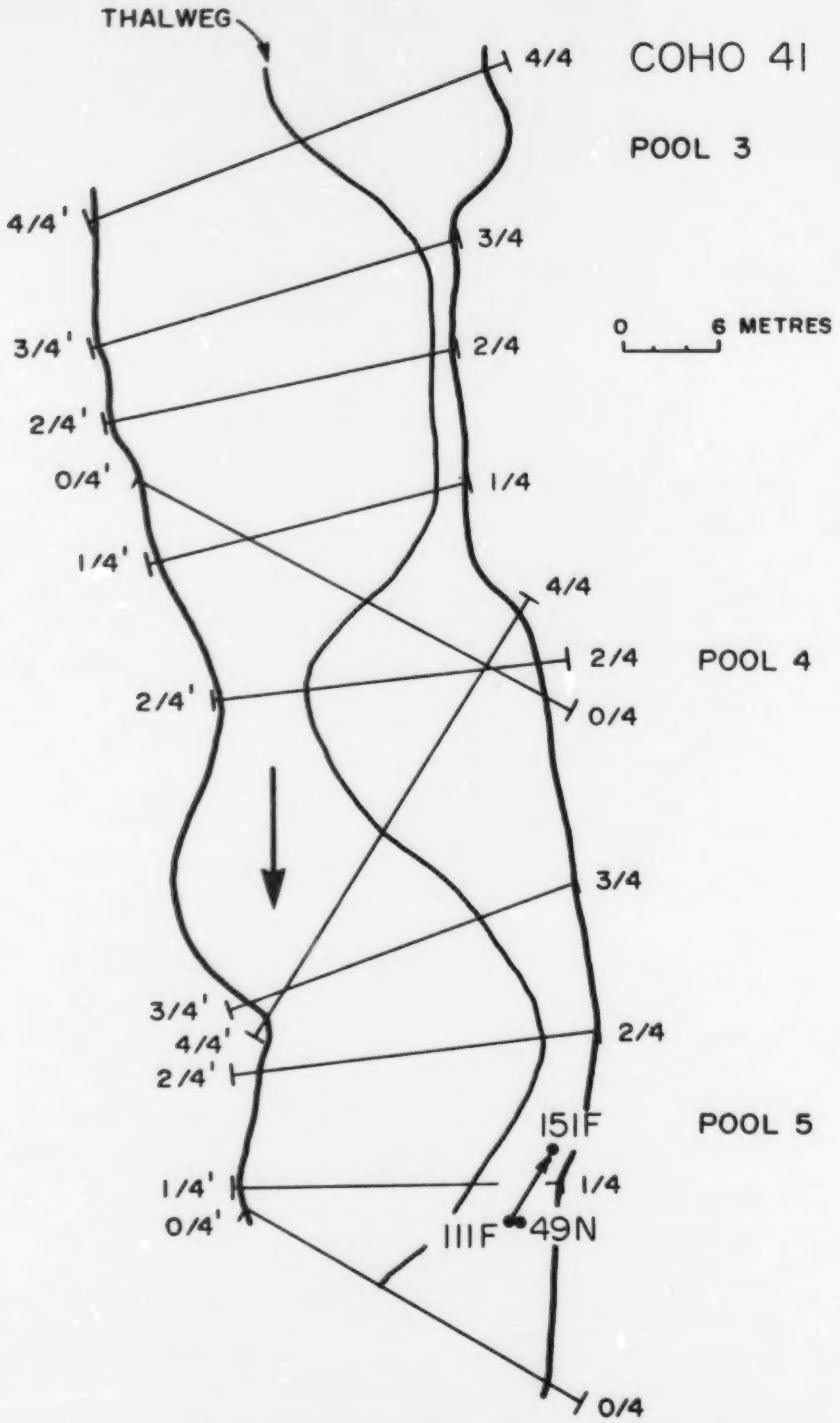

Fig. 26. Kloiya Creek. Map showing the tagging and recapture locations for coho 41.

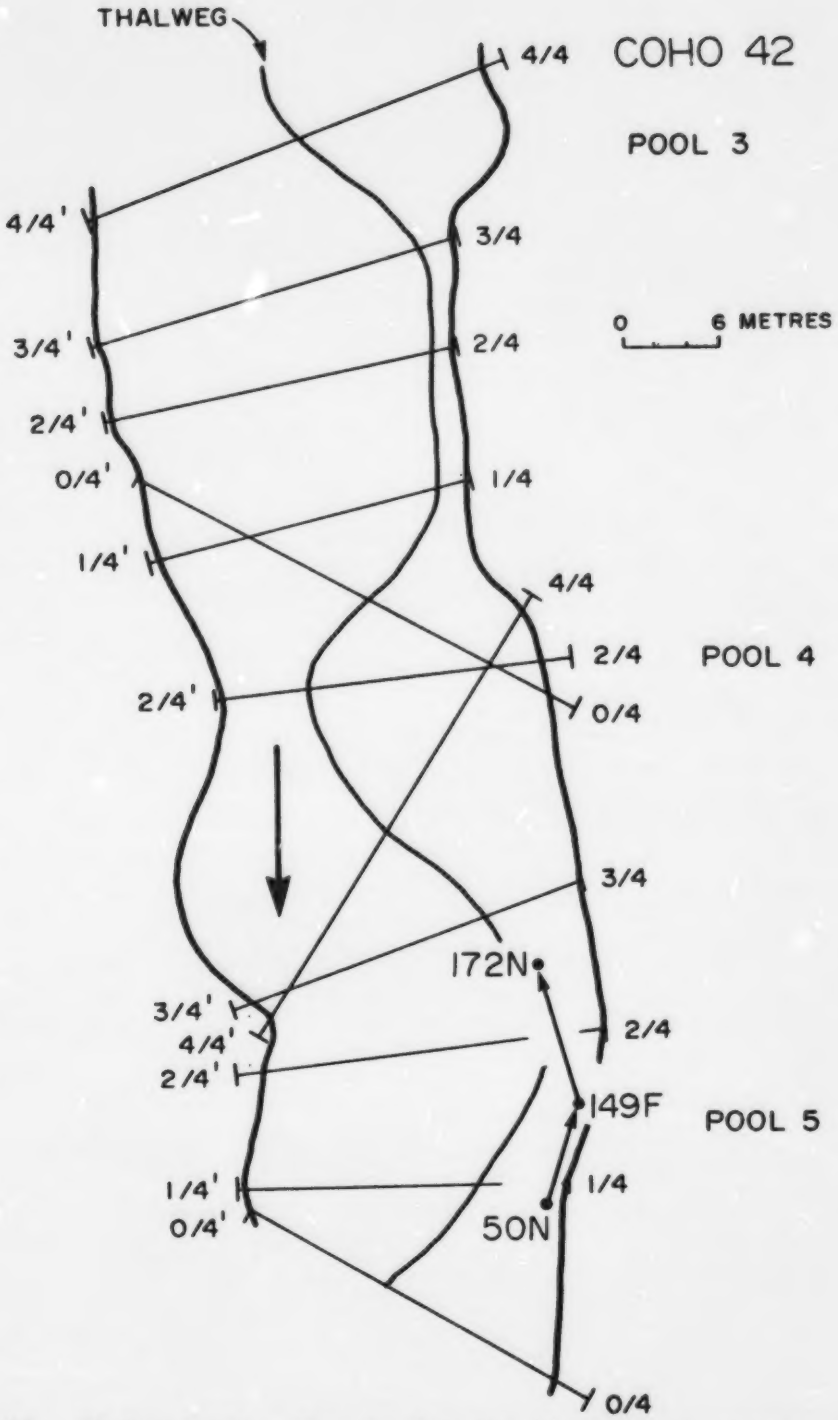

Fig. 27. Kloiya Creek. Map showing the tagging and recapture locations for coho 42.

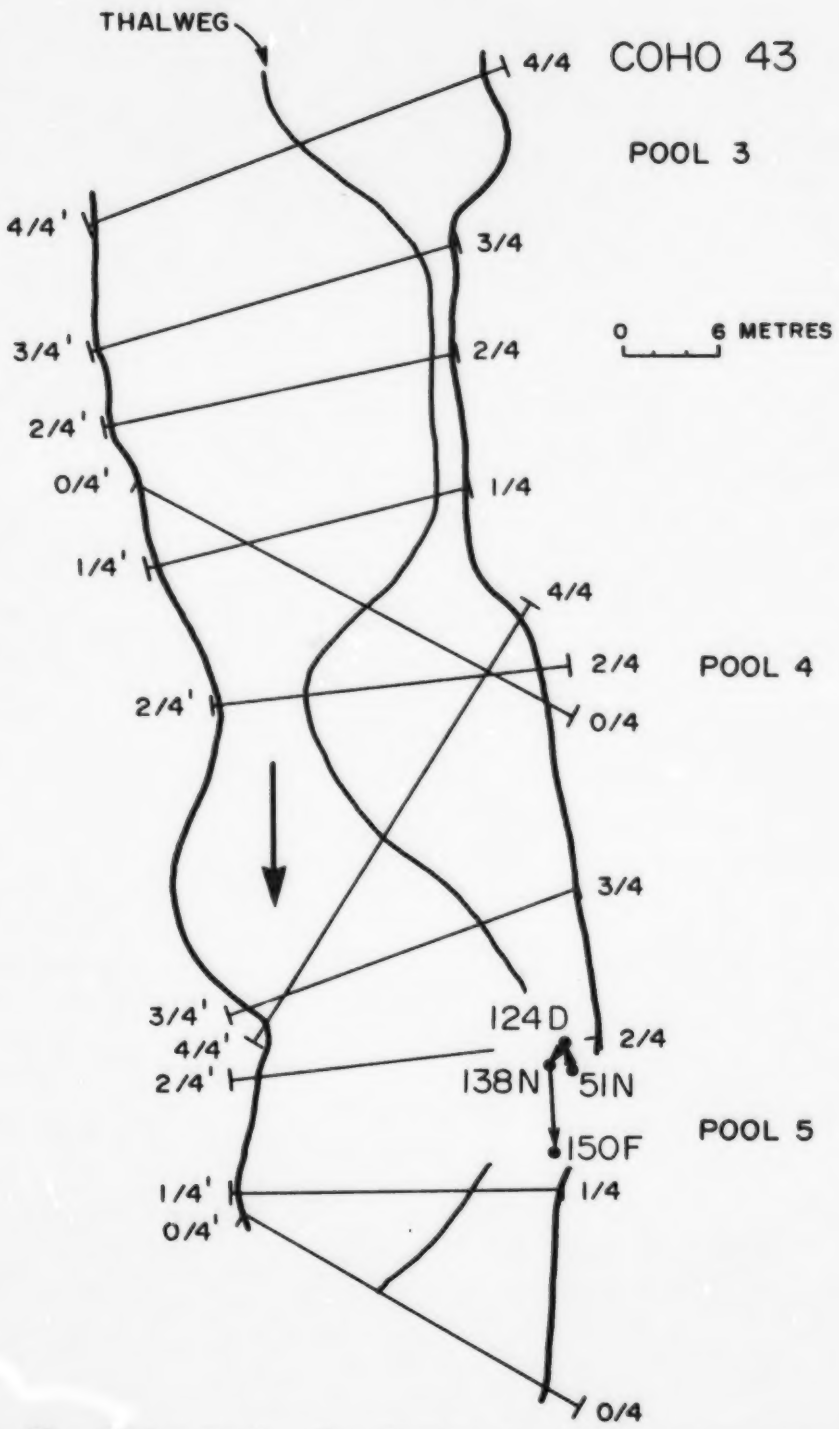

Fig. 28. Kloiya Creek. Map showing the tagging and recapture locations for coho 43.

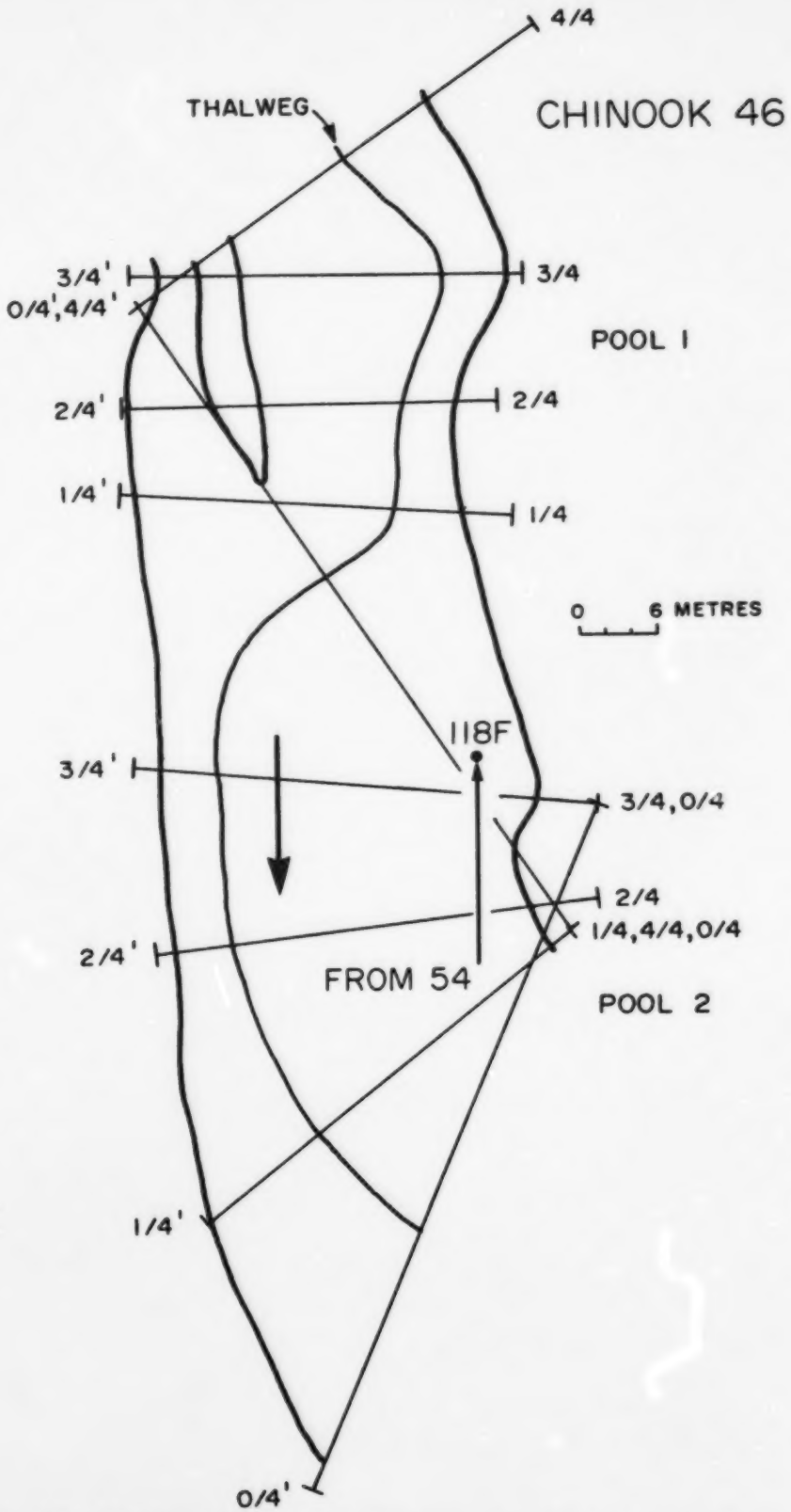

Fig. 29. Kloiya Creek. Map showing the tagging and recapture locations for chinook 46.

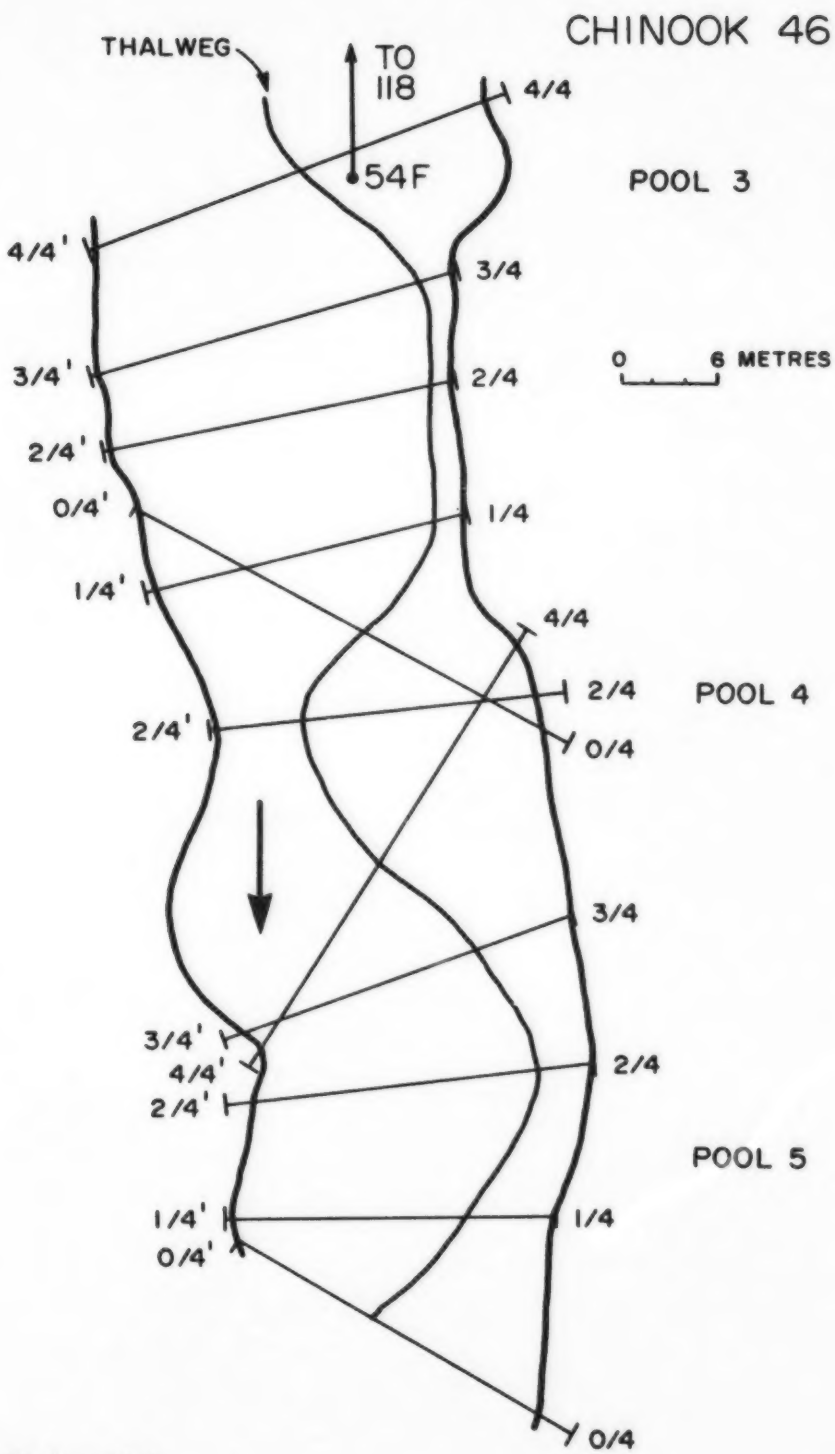
CHINOOK 46
THALWEG
TO
118
54F
4/4
POOL 3
4/4'
3/4
3/4'
2/4
0 6 METRES
2/4'
0/4'
1/4
1/4'
4/4
2/4
POOL 4
2/4'
0/4
3/4
3/4'
4/4'
2/4'
2/4
POOL 5
1/4'
1/4
0/4'
0/4

Fig. 29 (cont'd).

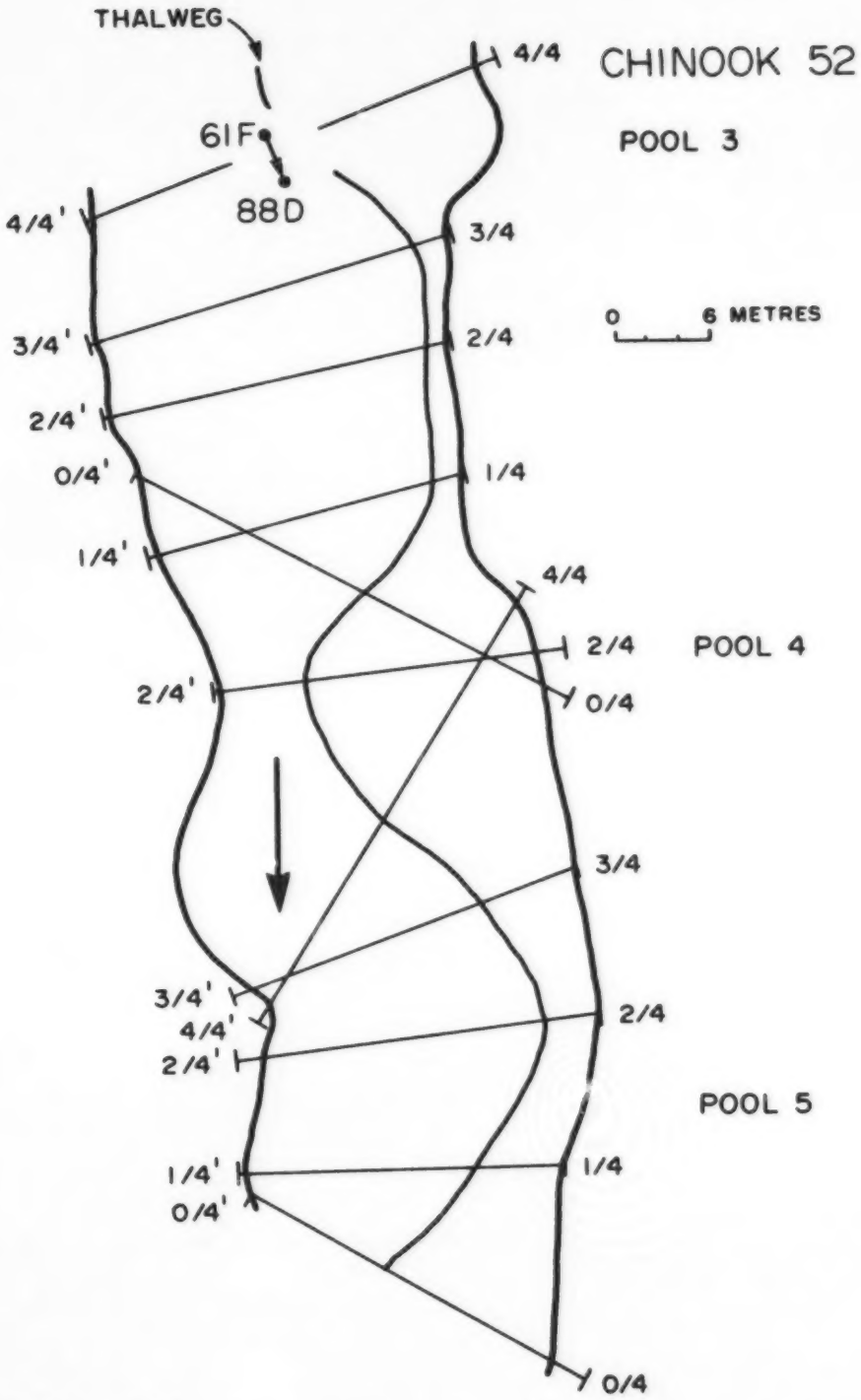

Fig. 30. Kloiya Creek. Map showing the tagging and recapture locations for chinook 52.

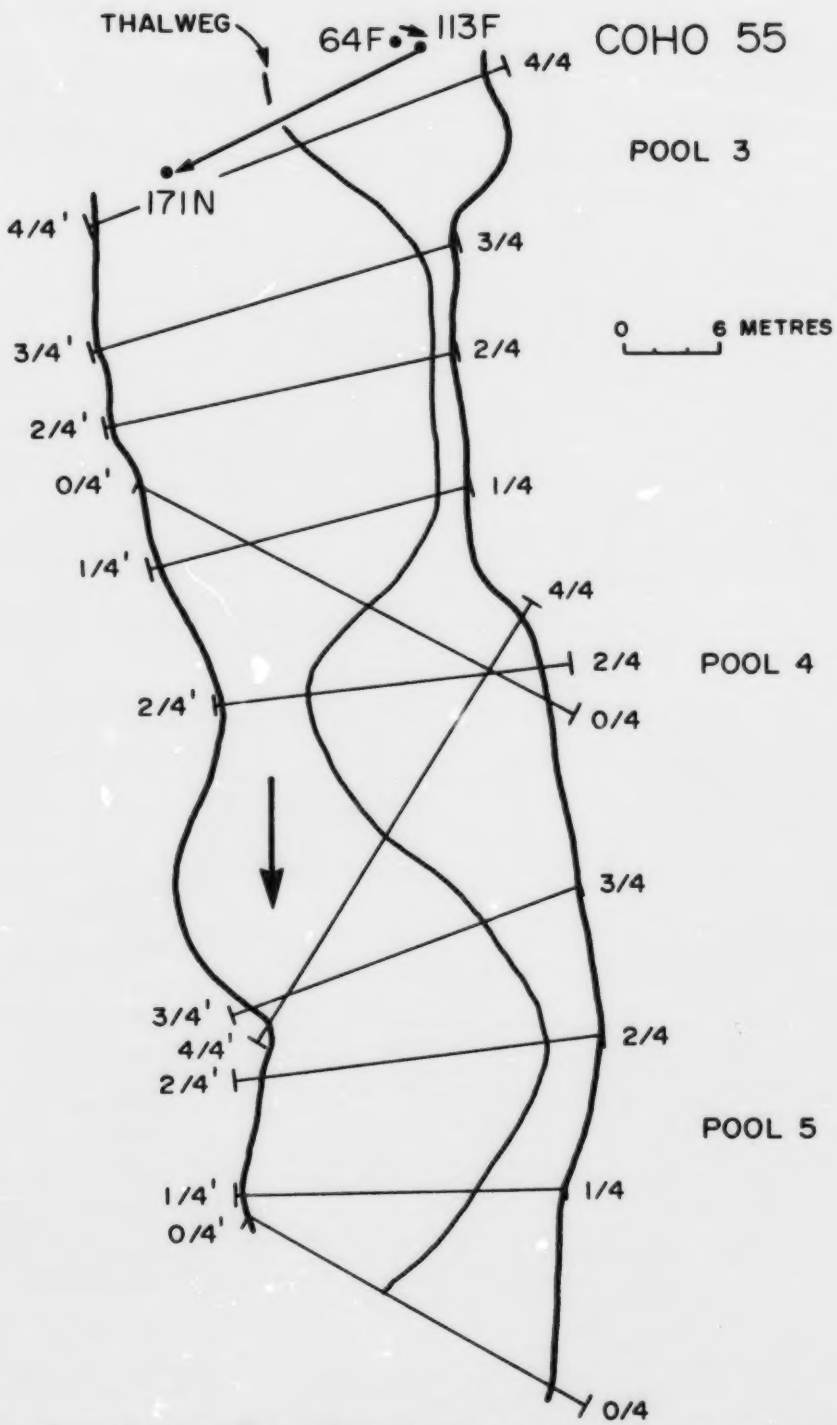

Fig. 31. Kloiya Creek. Map showing the tagging and recapture locations for coho 55.

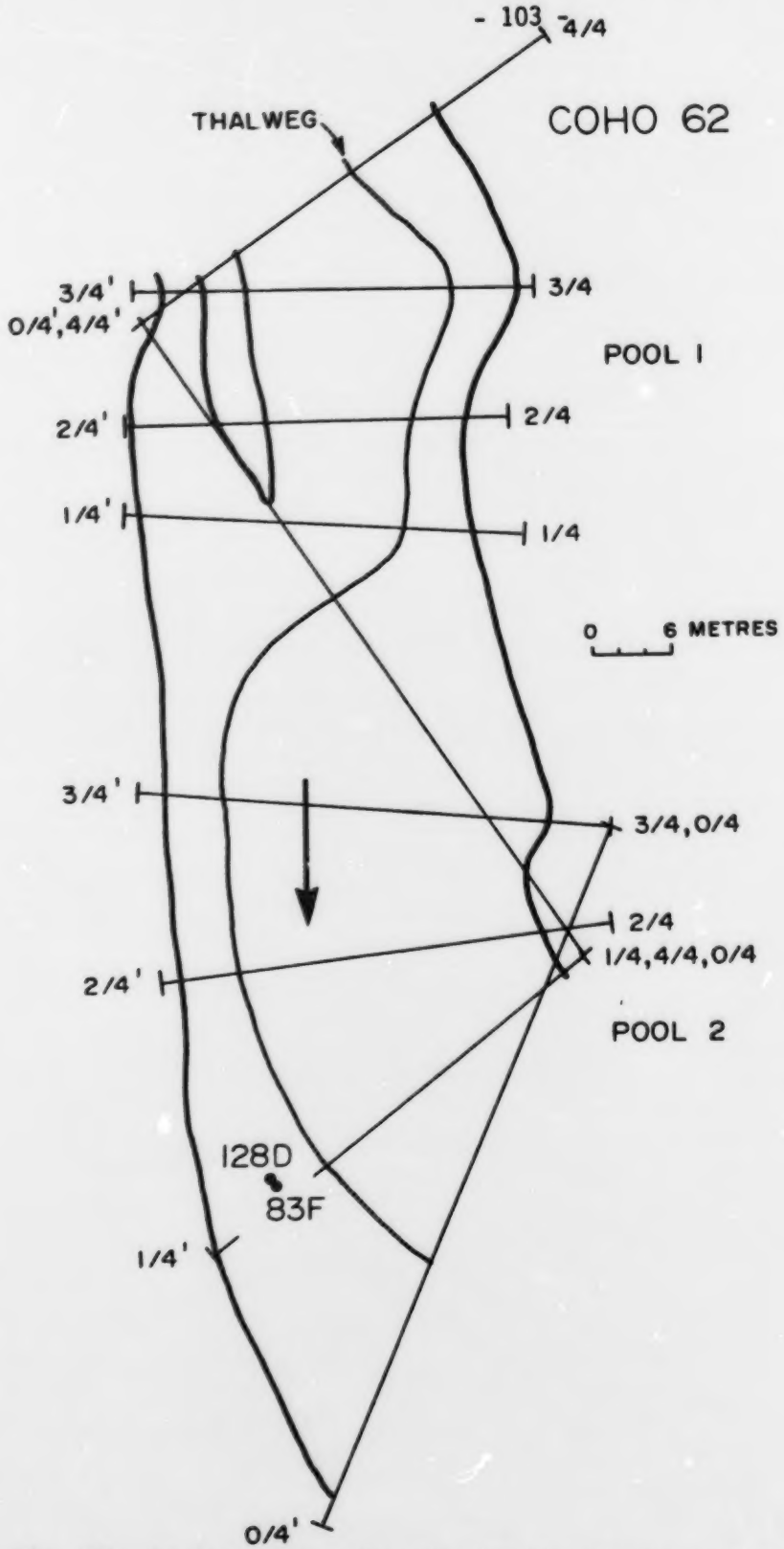

Fig. 32. Kloiya Creek. Map showing the tagging and recapture locations for coho 62.

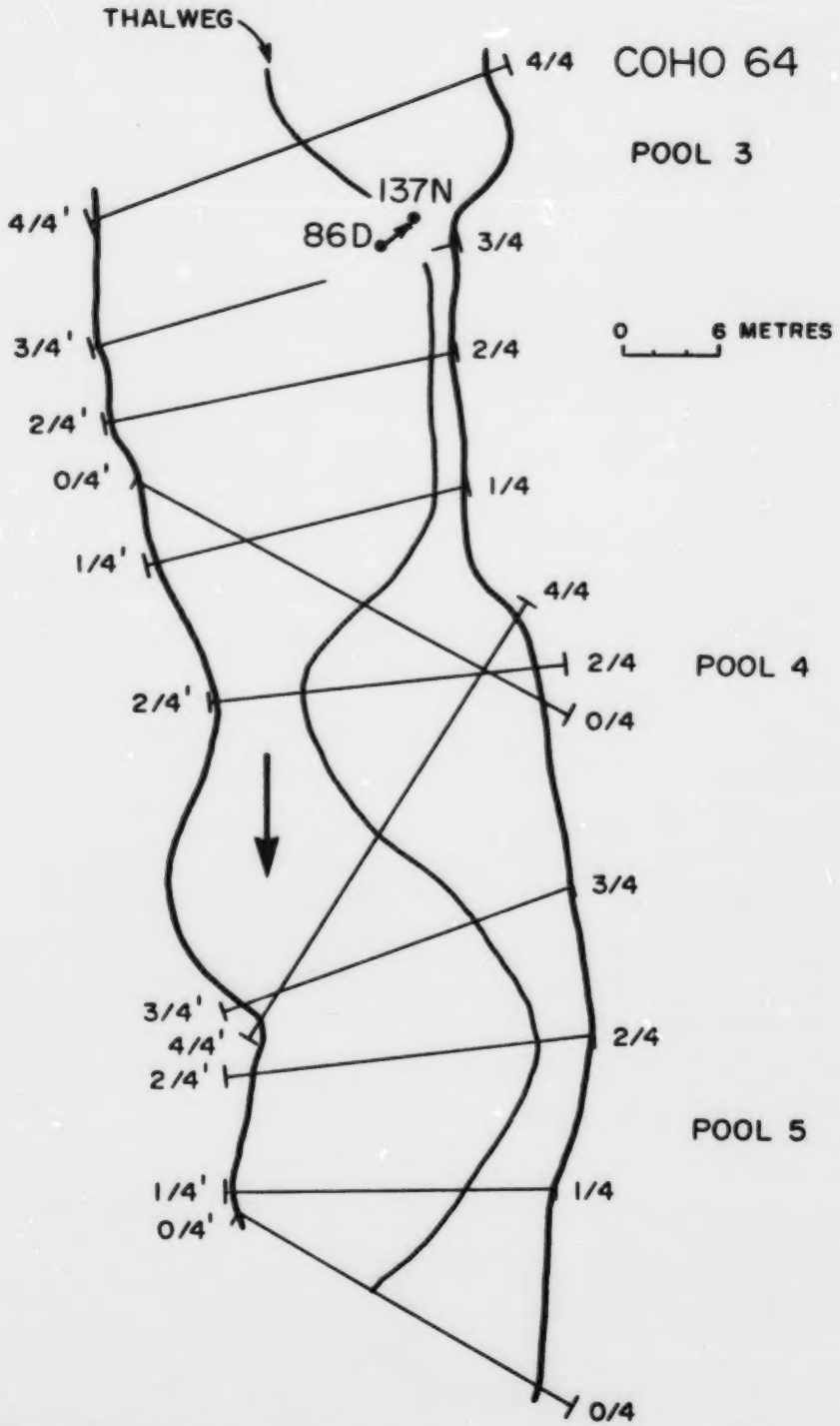

Fig. 33. Kloiya Creek. Map showing the tagging and recapture locations for coho 64.

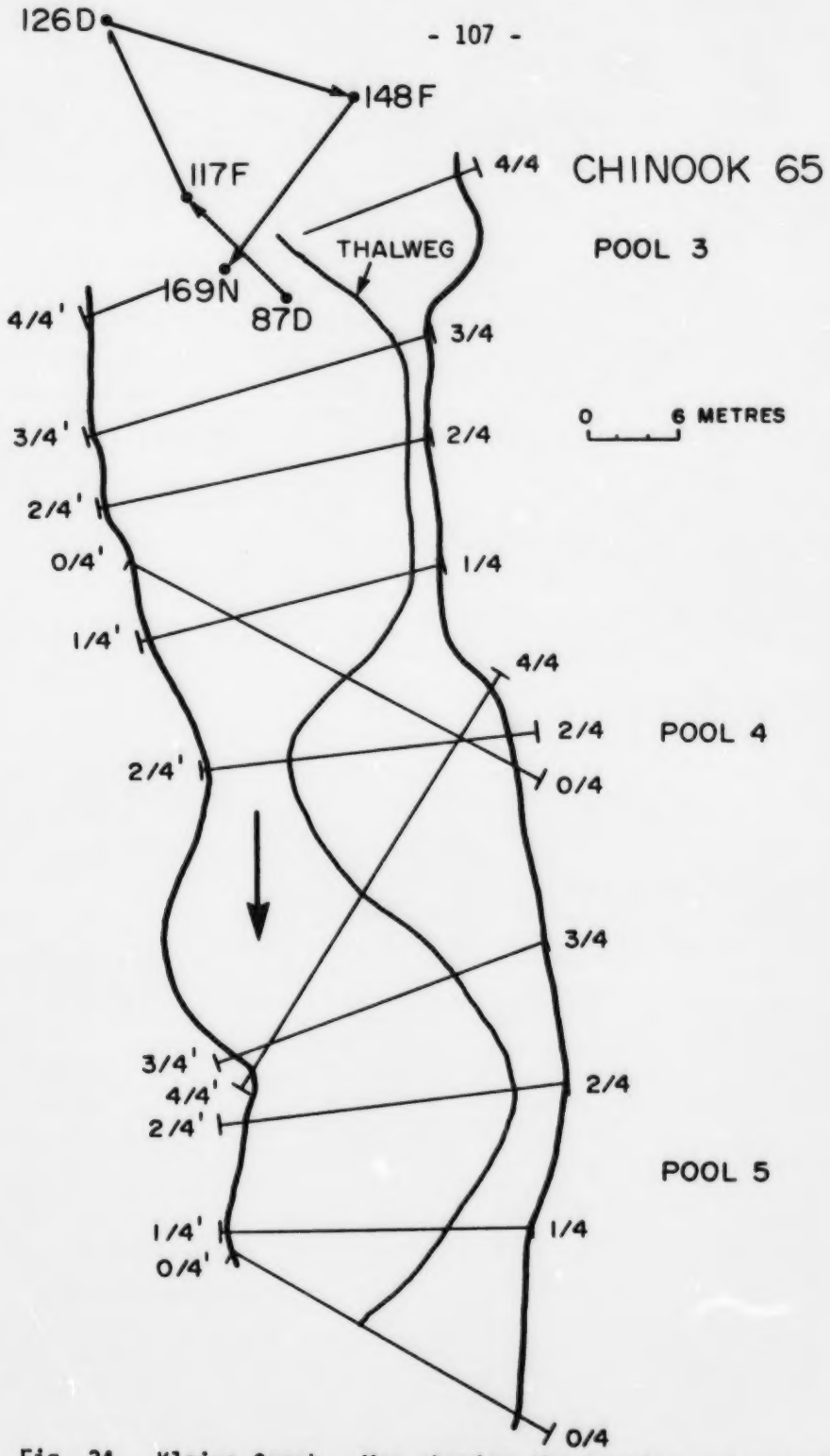

Fig. 34. Kloiya Creek. Map showing the tagging and recapture locations for chinook 65.

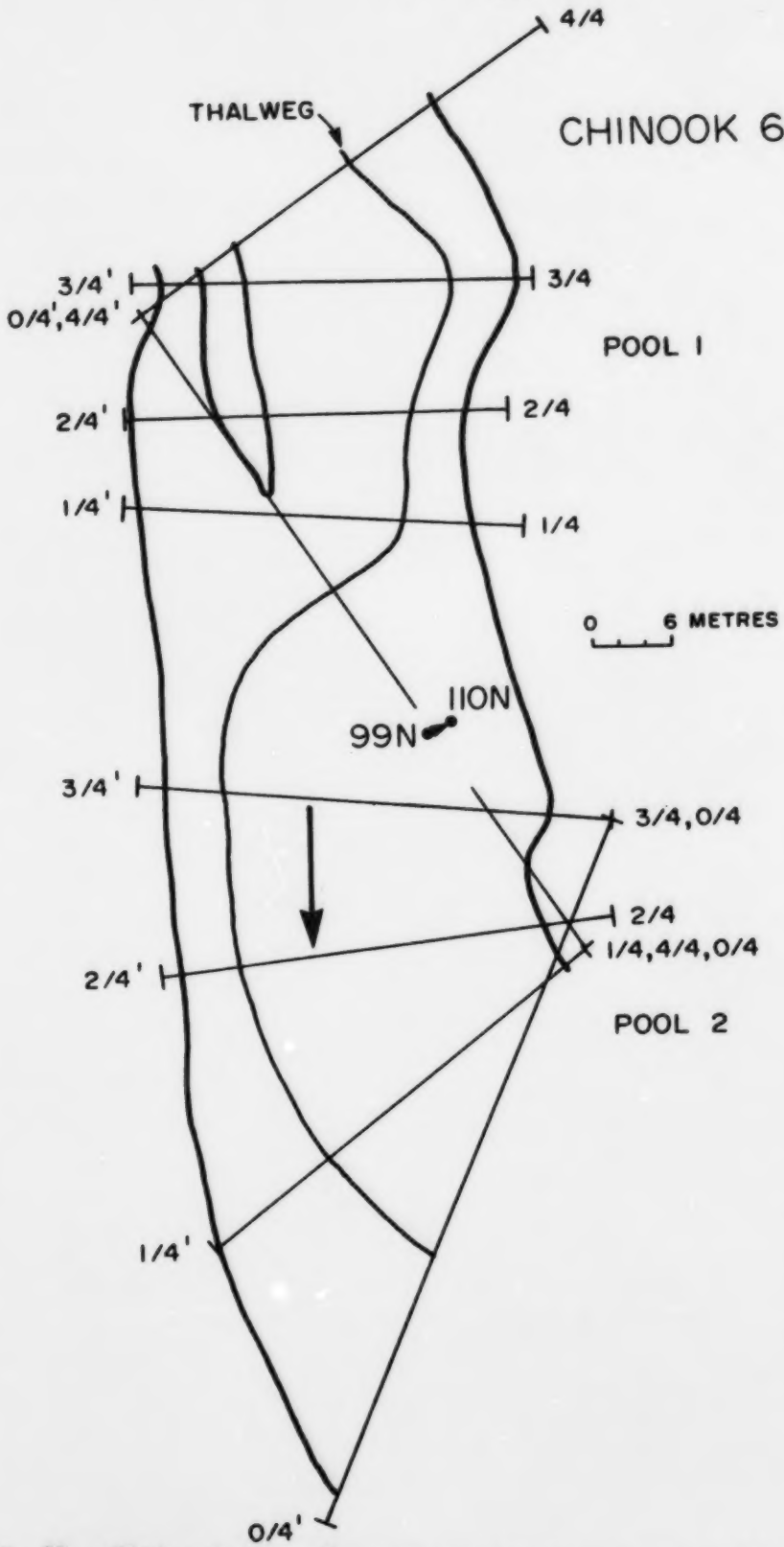

Fig. 35. Kloiya Creek. Map showing the tagging and recapture locations for chinook 68.

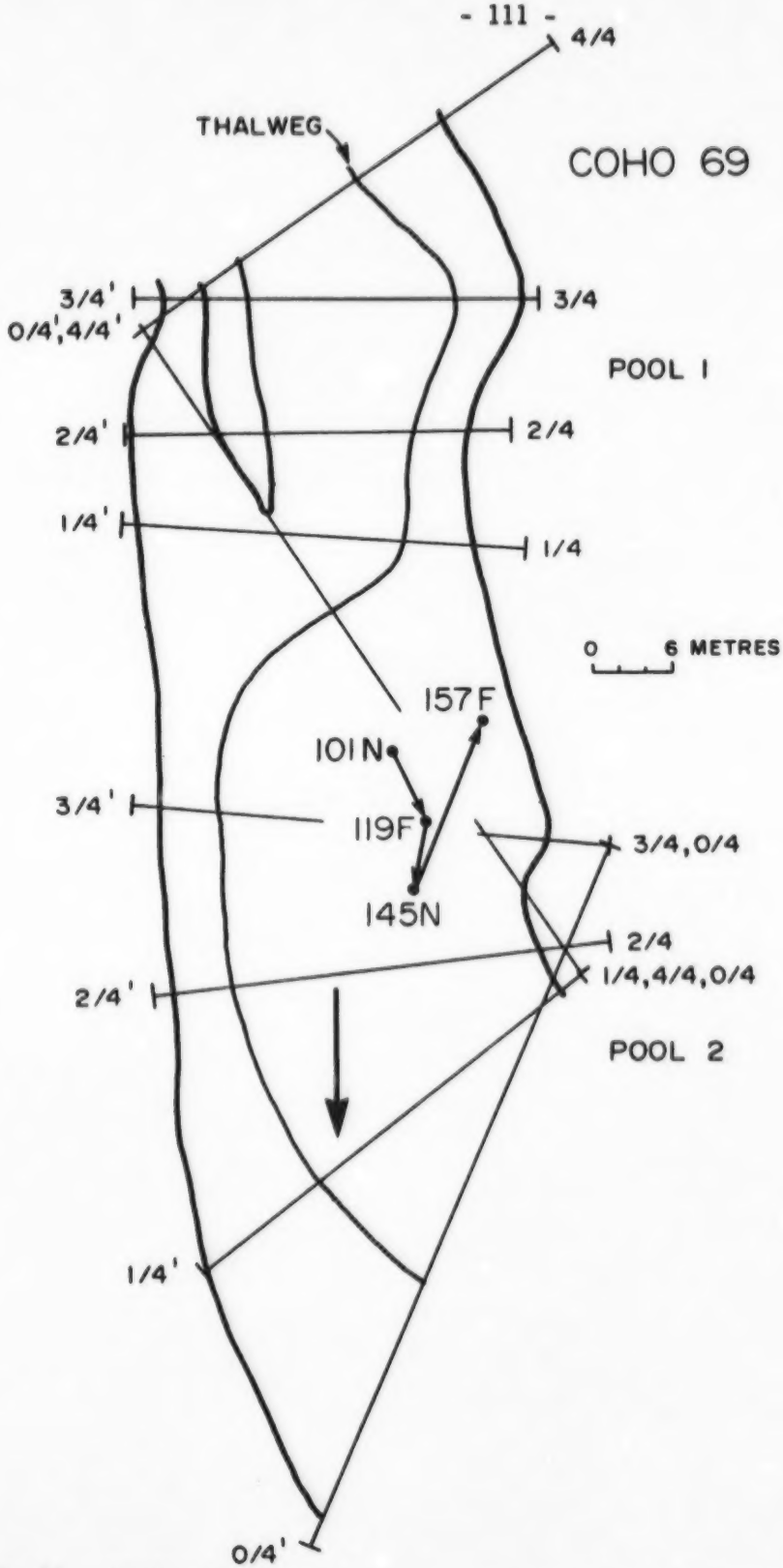

Fig. 36. Kloiya Creek. Map showing the tagging and recapture locations for coho 69.

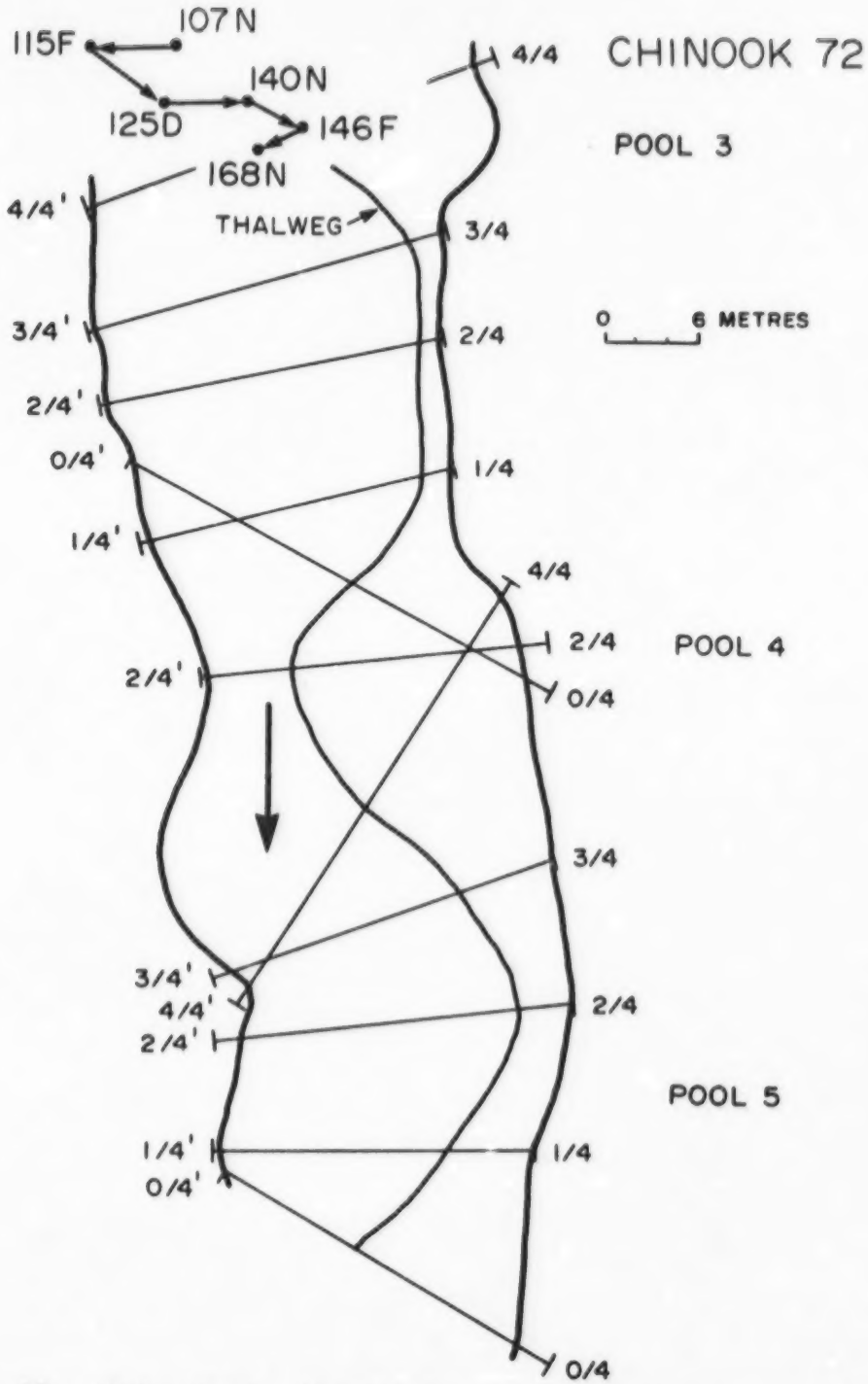

Fig. 37. Kloiya Creek. Map showing the tagging and recapture locations for chinook 72.

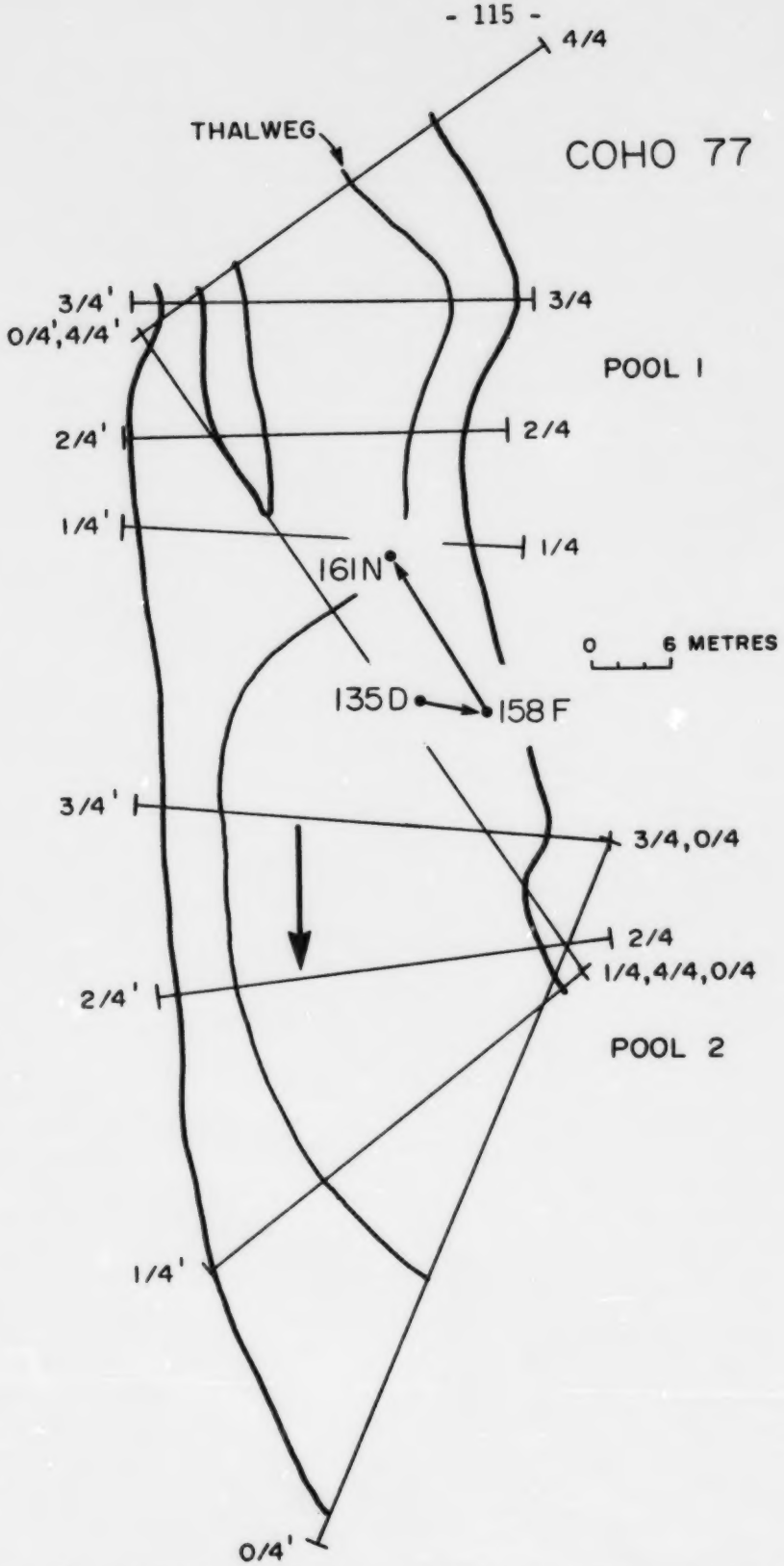

Fig. 38. Kloiya Creek. Map showing the tagging and recapture locations for coho 77.